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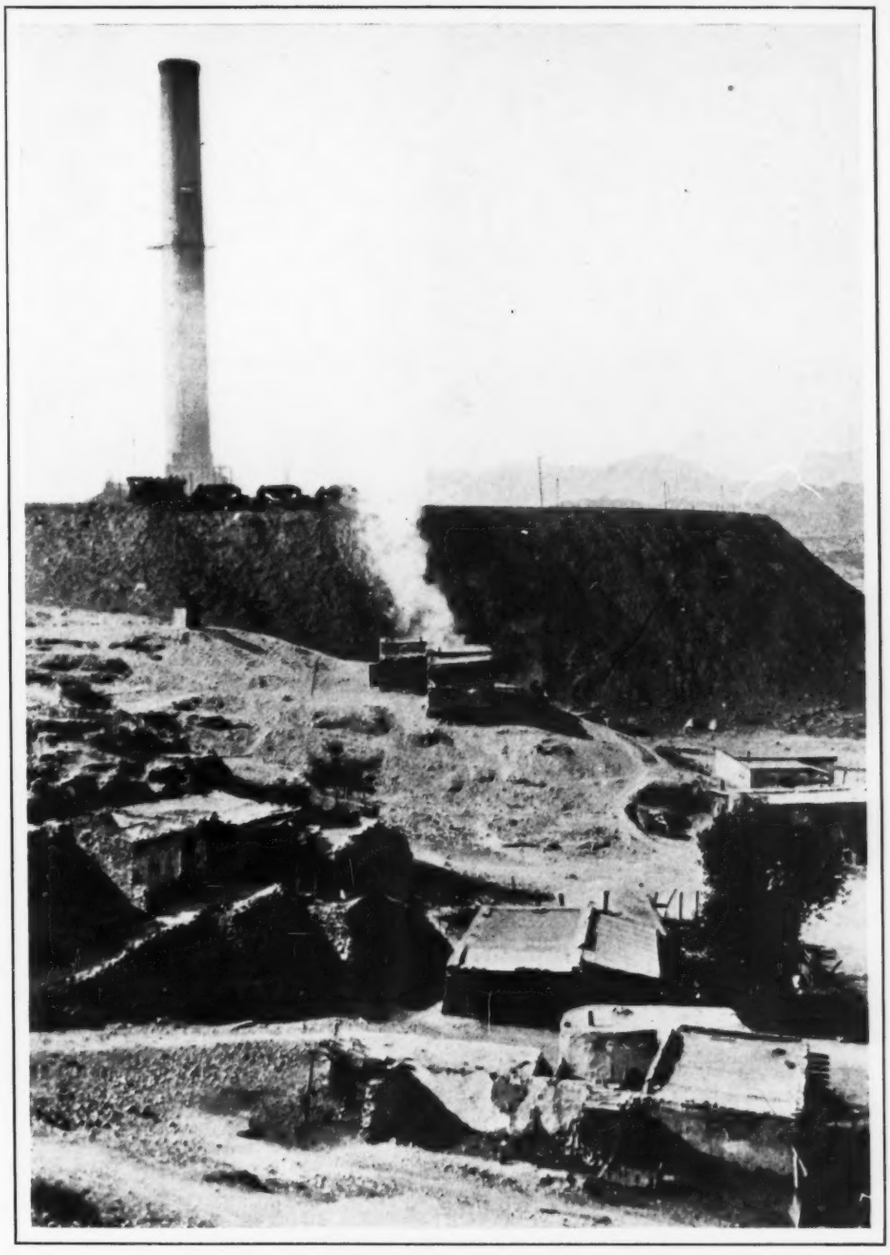

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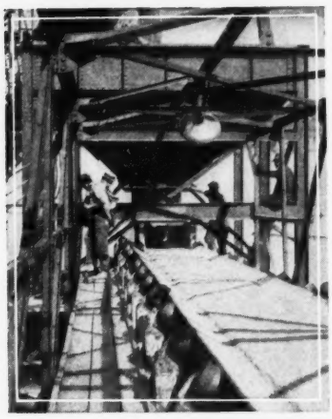

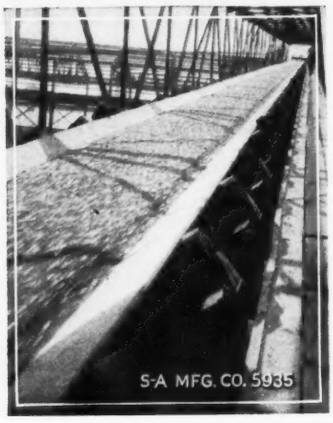

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 119 | New York, June 27, 1925 | *Number* 26

Mineral Resources Statistics

THE PASSING of the Mineral Resources Bureau from the Geological Survey to the Department of Commerce calls for a little comment. The Bureau of Mines has long gathered certain mineral statistics, especially as to the consumption and stocks of petroleum; but production statistics of all minerals, including petroleum, have remained with the Geological Survey, where the production statistics originated prior to the creation of the Bureau of Mines. Somewhat anomalous as the situation was, it is indubitable that production statistics were gathered and interpreted by the Survey in a wonderfully efficient and intelligent manner. The reason for this was their supervision by a corps of geologists, expert in the different metal and mineral products. It takes more than a statistician to gather, interpret, and present statistics so that they shall be of use. This has been exhibited by the mineral statistics of the U. S. Census Bureau (also of the Department of Commerce), which have been highly unsatisfactory and inaccurate at times, for want of skillful professional management and interpretation; with the result that a Geological Survey geologist was placed in charge of the last census.

There are certainly reasons for the uniting of all mineral statistics in one department, although they will still be in two bureaus, that of Mines and that of the Census, which will doubtless create as much difference of opinion as the old question between the Geological Survey and the Bureau of Mines, in the Interior Department. As an institution, the Geological Survey has lost some profitable business. As individuals the geologists of the Survey will be better off. The mining industry will distinctly suffer from the transfer, to all appearances. As to the Bureau of Mines, no one can tell whether it will gain or lose. It is in process of metamorphosis and no one can tell what it will turn out to be.

High Wages in the United States

THE AMERICAN workingman is far better paid, in terms of real buying power, than in any other country of the world, according to a statistical research by the National Industrial Conference Board. The wage earner in the United States receives twice the pay of the British wage earner, wages being figured back to a basis of what his money will buy in the respective countries; he earns three times as much as the Dutch or German worker; and nearly five times as much as his Italian brother. The survey was made, in order to be specific, in typical cities selected in each country, Philadelphia being selected as the American type. Australia and Canada come nearest to the American standard, Sydney rating 70, and Ottawa 69, to Philadelphia's par at 100. Next comes London at 45. Stockholm rates 36, Paris 33, Brussels 28, and Rome, Vienna, and Warsaw each 23.

Considering these figures, it is easy to see why there is such a pressure of immigration against our gates; and why the American worker is firmly against any loosening of these flood-gates, which would result in lowering his compensation, without raising to any great extent the great ocean of economic slackness in the world beyond.

The Russian Manganese Concession

THE RUSSIAN manganese district of Chiatouri (Georgia) has been conceded by the Soviet Government to W. A. Harriman & Co. of New York. In an editorial in our issue of Dec. 20, 1924, we chronicled the progress of competition for this concession, which was being sought not only by the Harriman firm, but by German interests, through the Deutsche Bank, and also by British interests. At that time the Soviet Government hoped for recognition by the United States as a part of the premium paid for the concession. Evidently satisfied that this is not to be had, the contract is nevertheless awarded to the New York group, probably on account of the certainty of ample capital. The Soviet Government will be paid at once $1,000,000 against the first year's royalties.

There are three chief sources of manganese in the world—India, Russia, and Brazil. So vast are the manganese resources of each of these countries that no one has any chance of creating a monopoly. Therefore the practical monopoly of Russian production which the Harriman group obtains does not by any means signify a monopoly of the manganese market. The competition is keen and the average profit low. Russia was a great producer before the World War, but under a Soviet Government monopoly the production has shrunk to a fraction of the pre-war amount. Evidently there is no money in it for the Soviet Government under communist management, and it is anxious to hand over the business to Americans, in order to profit more largely thereby. It remains to be seen what the financial outcome will be for the American group.

The United States has vast resources of iron ore, and is the greatest steel-manufacturing country in the world. Steel cannot be made without manganese; and the United States has relatively small manganese resources. Therefore before the war she imported largely from each of the three major producing countries mentioned; and when the Russian supply was cut off, increased her importations from India and particularly from Brazil. This great steel industry is the market in the United States toward which the Harriman company looks; and it is to be assumed that the market has been long arranged, and that the United States Steel Corporation and the Iron and Steel Institute have gone over and approved the project. Thus American steel makers secure a preferred supply of cheap manganese. It is reported also that German and English interests figure somewhat in the concession; which may well mean that some arrangement has been made to insure a certain market in Germany and in England. As noted in our editorial of Dec. 20, Germans apprehended, in the American effort for the concession, a

campaign to get control of the German steel industry. While the object was probably simpler—namely, the advantage of the American steel industry—it seems clear that this will also give the American industry some influence in the German industry; and the German industry, it is reported, has been recently strengthening commercial advantages over that of France.

From the standpoint of the man on the street the situation is not very disturbing. He will not be inclined to approve too strongly of American capitalists trading with the Soviets, and putting funds into its hands to be used in subversive propaganda, the latest outbreak of which is in China. But if Mr. Borah's philosophy is right, such commercial arrangements as this may speed the process of overthrowing the Soviet system of communistic principles, and help to return to the building up of a more normal and prosperous government. It is not easy to prophesy. The mere fact of this concession shows that the Soviets have sacrificed their fundamental principles for cash, and as they also hope, for favor.

Dissatisfaction With Fluorspar Prices

CONDITIONS seem thoroughly unsatisfactory in the American fluorspar market, whether judged from the viewpoint of producers or of consumers. Many producers are having a hard time, because present prices are not sufficiently high to assure them a reasonable profit. Though lump and gravel spar of 85 per cent purity are selling at $18@$19 per ton, prices well above pre-war levels, increasing costs have more than offset the higher price. Labor is expensive, though there is said to be much unemployment in the fluorspar mining districts; then too, mechanical mining operations are more difficult, many of the present deposits necessitating deep mining with a large amount of water to contend with. Furthermore, high-grade deposits are scarce. United States production in 1923 was 121,000 tons, about equal to that just before the World War, but it is thought that the 1924 production will be much lower than that, and the industry so far in 1925 has certainly not been active. Imports are held to be to blame; if it were not for these, the demand would be sufficient to make producers moderately active. Imports for 1924 were 42,000 tons, about double the rate in 1912 and 1913, and so far in 1925 are at the rate of 55,000 tons a year.

Consumers have quite a different story. They say that present prices are exorbitant, the weighted average for all grades being around $20 compared with $7 before the war, a much greater percentage of increase than for most commodities. Therefore, they have encouraged foreign sources of supply. A very pure acid-grade spar has been imported from Transvaal, but Great Britain has supplied about 60 per cent of the imports, cost of production and freight being low.

Producers have appealed to the government to solve their difficulties, and look with favor on a higher tariff. Previous to 1909, we believe, fluorspar was on the free list; than a duty of $3 was levied; the Underwood act of 1913 decreased this to $1.50; and the Payne-Aldrich bill of 1922 raised it to $5 per ton, or almost equal to the pre-war selling price of the mineral. Even this is not sufficiently high to protect many producers under present conditions and to assure them a fair return on their investment.

Pre-war prices of fluorspar were undoubtedly lower than were justified by the cost of production. They were the result of bitter competition, and caused producers to mine only the highest grade of ore and throw away much of the poorer material. Even at present prices, fluorspar resources are not being properly conserved, and they are extremely limited; fluorspar is not so common a mineral as one might think. A considerably higher price would be necessary to enable producers to do efficient mining from the conservation standpoint. In England, much of the fluorspar production formerly came from lead tailings; these have now been largely exhausted, so the mineral has to be mined, and there also the low-grade spar must be passed by with the present scale of prices.

Possibly 85 per cent of the fluorspar mined goes to the steel industry, and as only about 8 lb. of spar is used in the making of a ton of steel, the difference in cost to the steel maker would be only 8c. a ton if fluorspar were $40 a ton instead of $20. Advocates of a higher tariff would seem to have much support for their arguments. Some of the producers, of course, are owned by consumers, and they would probably prefer to get the material as cheaply as possible, but a proper regard for the future would argue for prices high enough to insure economic operation of the mines.

Xanthate and the Copper Mines

THE ADVENT of potassium xanthate in flotation practice in the milling of sulphide copper ores has resulted in improved recoveries, increased grade of concentrates (higher concentration ratio), a reduction in the number of cleaner cells required, improved thickening and, therefore, fewer thickeners for a given tonnage, and improved filtration, resulting in the use of fewer filters and a lower moisture content in the concentrates.

The new reagent was not accidentally discovered, but was the result of systematic research. Cornelius H. Keller, a chemist, was engaged in the investigation of methods for the sulphidizing of oxidized copper minerals and tried out systematically the alkali-sulpho salts. Among these was potassium xanthate, which had been used in dye work and as an insecticide. Its use in testing ores discovered the fact that good results were obtained, and many additional tests in the Minerals Separation company's laboratory substantiated the preliminary conclusions that potassium xanthate is an unusually fine "conditioner" for the flotation of sulphide copper ores. In co-operation with Carl P. Lewis, the details of its application to flotation were worked out. These were not the only workers in the field, for the Metals Recovery Co. also developed a reagent that contained a considerable proportion of xanthate.

A small quantity of the new reagent was made by the Great Western Electro Chemical Co. and was sent to Anaconda in May, 1923. The preliminary tests were favorable and in a short time Anaconda adopted the reagent. Arrangements were made by Minerals Separation for the manufacture of the reagent upon a commercial scale with the Western Electro Chemical Co. at its Pittsburg, Calif., plant. This arrangement, we are informed, gives no profit to Minerals Separation upon the manufacture and sale of the reagent and limits the profit to be made by the chemical company. Since the pioneer work at Anaconda, other large copper companies have adopted the reagent. Miami, Inspiration, Ray, Nevada Consolidated, the Phelps Dodge

group, New Cornelia, and several smaller mines are using it. We are informed that Utah Copper is about to begin its general use.

Pine oil will continue to be used in conjunction with the new reagent as well as other reagents. Up to the present the potassium salt has been used. Experiments with sodium xanthate have been made, but the results are not usually so good as with the potassium compound.

Credit is due to Cornelius H. Keller and to Carl P. Lewis for their research work and to Minerals Separation for its enterprise in introducing this important flotation reagent. Credit should also be given to the Metals Recovery Co. Probably the most significant point is the emphasis placed upon the value of research as one of the important methods of increasing the spread between income and outgo. Every going mining enterprise is a challenge to the technical man to improve existing conditions by finding another way out, and a better one, whether it is in the mining or in the milling of the ore.

Lead in "Leaded" Gasoline

WHATEVER THE OUTCOME of the inquiry of the Surgeon General of the United States regarding the use of tetra-ethyl lead as an agent to produce a non-knocking gasoline, the lead-mining industry will not by any means be revolutionized. Taking the figure of gasoline consumption in 1924 as 8 billion gallons, in round numbers about 27,000,000 lb. of lead would have been required to produce sufficient tetra-ethyl to treat all of it. The dilution heretofore used has been 1 part tetra-ethyl to 1,300 parts of gasoline by weight. The compound $(C_2H_5)_4Pb$ contains approximately 64 per cent lead.

It is true that the expansion of the motor industry will increase the consumption of gasoline; but, on the other hand, the increased efficiency of the high-compression engines that will be practicable when a treated gasoline is used will tend ultimately to offset this increase. Even granting an increase of 50 per cent in the consumption of gasoline for motors, and assuming that every gallon used was treated, the lead required in a year could be supplied by about forty-five days' production of the St. Joseph Lead Co. in Missouri.

Achievement in Birmingham

WHEN the mining engineers visited the Birmingham district, in Alabama, last fall, one of the interesting projects then nearing completion there was the new "High Line," the standard-gage road that the Tennessee Coal, Iron & Railroad Co. was building in order to bring its iron ore direct from the mines on Red Mountain to the furnaces at Fairfield. This important link has been placed in operation, it was recently announced, and will greatly facilitate the handling of the quarter-million tons or so of ore that is transported every month. Throughout its length of five miles, cutting across the network of railroads that serve the district, all grade crossings have been eliminated. The road passes through Flint Ridge in a 58-ft. cut with a top width of 188 ft. at its deepest point. Nine bridges requiring more than 1,700 tons of steel and 18,000 cu.yd. of concrete masonry, and 1,300,000 cu.yd. of fill were needed in carrying it 15 to 50 ft. above the level of the valleys that it crosses. A huge undertaking in itself, yet but a detail of the cyclopean fabric that the making of iron and steel requires, it epitomizes the wonderful development of the district—a district whose history is marked with great achievements. It was in 1907 or 1908 that the most important improvement, economically, was made. It was then that the beehive oven gave way to the byproduct oven for making coke. Not only was the yield of coke thus increased from 60 to 73 per cent, but the tar, gas, and oil, once wasted, were put to useful work. The process of improvement is continuous—in the mines, both of ore and coal, as well as at the furnaces and in the fabricating plants. In the future lies the problem of beneficiating the district's low-grade ores, eliminating the present waste, a problem that the Bureau of Mines has undertaken to study and that in time will be forced upon the operators, though not immediately pressing.

The Prince of Miners

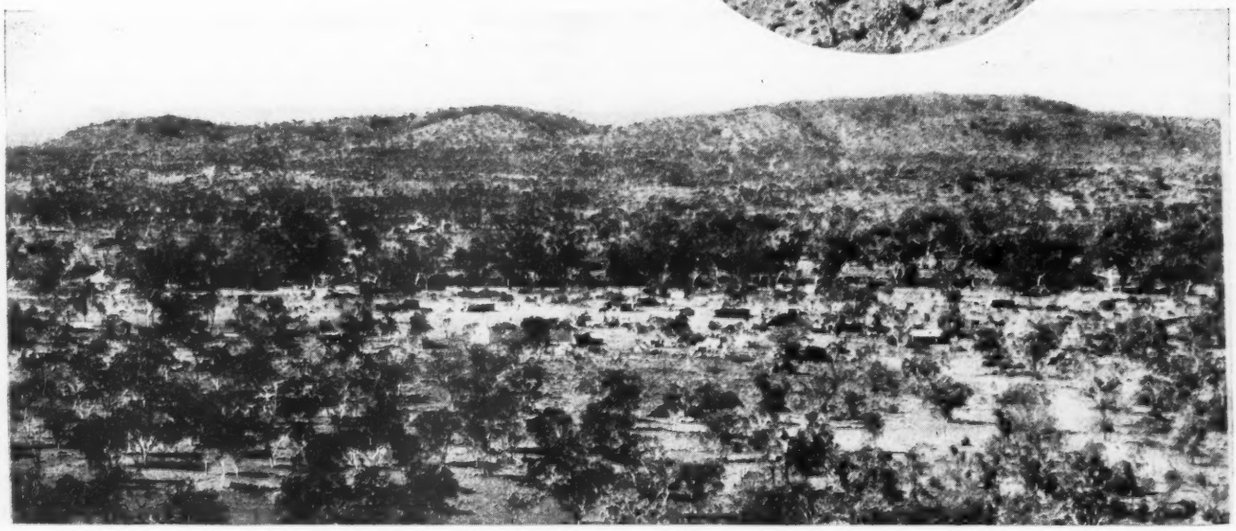
ONE of the most irresistibly fascinating performances is the steam shovel in operation. Walk along the streets of New York—more hard rock "mining" has been done on the mass of schist that forms Manhattan Island than in any mine or quarry in the world—and you will invariably see a crowd of people looking on wherever a steam shovel is at work. The almost human motion, the more than human strength, the rhythm of the whole cycle of digging, swinging, dumping, and digging again! The superintendent of a big open-cut mine once observed that he seldom went up to the pit in the morning that he did not find himself lingering on the bank for a few minutes to marvel at the shovel. It enthralls the hardened old campaigner no less than the casual spectator. A mass of steel and copper, lead and zinc, fed with water and coal does the work of anywhere from 25 to 1,000 men, for the big shovels in the copper and iron mines have loaded as much as 10,000 tons per day.

But the giant machine is not independent. It must rely on a man, two of them in fact, to pull the levers that make it dig—which brings us belatedly to the point of the story. By long odds the best paid man in the mining industry, under the rank of foreman, is the engineer of a steam shovel. In fact, he receives more than a great many foremen. A compilation in the *Monthly Labor Review* of mine wages during 1924 shows that shovel operators in Minnesota were paid 99.7c. per hour, which, for a 60-hour week, made average earnings of $59.82. In Western copper mines the hourly wage was 90.1c. and the week 56 hours, making the earnings $50.46. In Alabama iron mines shovel men got only 54.6c. per hour and worked 60 hours per week for $32.76; but wages there are uniformly low. The next highest paid group is contract machine miners working underground in Western districts. They averaged 77.8c. per hour and worked 51.5 hours for $40.07 per week. Hoisting engineers at Western mines were next in the list, averaging $39.55 for a 54.4-hour week. The hoisting engineer is paid for being careful and dependable; the contract miner for working efficiently and hard—mostly hard; but the shovel engineer for a combination of mental alertness and manual dexterity, with the rare ability to co-ordinate these two instinctively. His judgment must be good and his head must be clear. He has under his personal control a machine that may be worth $100,000, and its efficiency, and often the whole output of a mine, depends directly on how well he operates it. He is, in a sense, the prince of miners, and rightly earns the highest financial reward.

In the Mount Isa District, Queensland

ABOVE—*Copper mine at Duchess, the nearest railway point to the Mount Isa field.*

LEFT—*Open cut on Laguna lease, Mount Isa.*



Camp at Mount Isa, in the region where a new silver-lead district was discovered in March, 1923. In the circle above —Racecourse Lease, Mount Isa

Photos by Courtesy of A. W. Newberry

Veindikes of the Engineer Mine, Near Atlin, B. C.

A Study of the Occurrence and Character of the Ore

By Walter Harvey Weed
Consulting Geologist, New York City

AN EXAMINATION of the gold-bearing veins of the Engineer group, having revealed geologic conditions heretofore unrecognizable, yet of considerable commercial importance, a brief account of these unique and exceptionally rich veins of magmatic origin is presented as a slight contribution to our knowledge of ore genesis.

The property was visited in the summer of 1924, before serious development had begun, but my study of ore occurrence and character has been confirmed by later work and corroborated by the careful petrographic work and study of my specimens under the microscope, made by Prof. R. J. Colony of Columbia University.

Though known for many years, and having a production of several hundred thousand dollars from surface cuts and a shaft 235 ft. deep, the property was idle for six or seven years, owing to litigation, and it has been under active development only since late in 1924. A new hydro-electric plant five miles from the mine is now delivering 300 hp. and a crosscut tunnel is being driven to intersect the major gold-bearing veins at a depth of 250 to 500 ft. The mine is fully equipped for production as soon as sufficient faces can be opened up, and a 100-ton mill has been built on the lake shore.

View from Engineer Gold Mines Camp, British Columbia

The claims now owned by the Engineer Gold Mines, Ltd., are situated in the extreme northwest corner of British Columbia, close to the Yukon boundary and about 35 miles as the crow flies from Skagway, Alaska. The property comprises about 1,000 acres on the south shore of Taku Arm, a lake forming one of the headwaters of the Yukon. Atlin is but 30 miles away and a tourist steamer service to that place and to the mine connects with the Whitehorse Railway at Carcross. The scenery is extremely beautiful, as the glacier-crowned summits of the Coast range are but a few miles away.

The gold veins occur within an area of a mile or so long and a half mile wide which comprises the entire mineral area; similar veins occur near by, but are apparently without payable values. There are no other gold mines nearer than the Atlin placer fields, nor active mines of any kind near by.

The gold-bearing area lies east of the Coast range, that great mass of granitic peaks which for 1,000 miles borders the Pacific Ocean from Vancouver to Skagway. The veins are in the transition belt between these mountains and the Yukon plateau; and Engineer Peak, immediately back of the mine, is a flat-topped summit, that is itself a part of the plateau. It is a known fact that most of the ore deposits of British Columbia lie on the flanks of the Coast range batholith.

Erosion since the veins were formed has removed about 3,500 feet of rocks, that being the height to which Engineer Peak rises above the lake. Recent glaciers have left debris all over the tract and scored the rocky exposures. A half dozen glaciers, mere remnants of the great ice sheet, can be seen from the mine, and glacial debris makes prospecting difficult.

The broader geological environment is simple. The basement rocks are pre-Cambrian schists, overlain by the usual sedimentary series of British Columbia, including several thousand feet of very massive white carboniferous limestone. The gold area is covered by thinly bedded gray to dark gray shaly rocks of the La Berge series whose fossil remains are of Jura-Cretaceous age. These rocks are composed largely of andesitic volcanic material with interbedded shales and sandstones and an underlying conglomerate holding pebbles of the granitic rocks forming the core of the Cascade range.

Hundred-ton mill at Engineer Mine on the shore of Taku Arm

The geologic features observed at the mine are more unusual. The bedded rocks are on edge or lie at very steep angles, dipping toward Engineer Peak and the small stock of granodiorite exposed on the north side of the peak. This granitic rock cuts through and alters the bedded rocks. This is accompanied by a swarm

Photomicrograph of vein matter, taken in ordinary light, magnification about 35 diameters

Showing quartz veinlet of the third deformation period cutting roscoelite (spherulitic groups). Gold is associated with the quartz (black in this light), and it is distributed likewise in the roscoelite. The great patches are fine aggregates of sericitized feldspar, itself somewhat attacked and partly replaced by quartz which was associated with it.

of dikes, some of which are highly feldspathic porphyrites (or diorite porphyry), and others are smaller dikes of bostonite, trachyte, andesite, and trachy-andesitic; all being highly feldspathic rocks, characterized by the persistence of end-stage quartz, and all being probable differentiation products from a common magma of monzonitic character.

The veins are of various sizes, from a few inches to compound veins many feet across, but the rich gold ores appear to be confined to the smaller ones. The veins all cut across the uptilted beds at various angles both on dip and strike; but the displacement along the fissures is only a few feet, as shown by their faulting of the dikes. The distribution of the veins, and their structural relations and character, are thought to indicate tensional strain and cracking of the rocks above an uprising igneous mass, presumably followed by subsidence.

As the bedded rocks were steeply upturned before either dikes or veindikes were formed, a considerable time interval and crustal disturbance must have intervened between the deposition of these Jura-Cretaceous strata and ore deposition, and it is quite possible that the ores are of early Tertiary age.

In the limited exploration so far done along the veins it has been found that the characteristic rich gold ore occurs in well-defined oreshoots, separated by lean quartz or by sheeted rock. The extraordinary richness of the highest grade gold ore, which assays from $1 to $5 per pound, is not of course a measure of the value of the minable ore, but a 2-ton bulk sample from one oreshoot 6 to 24 in. thick and 20 ft. long contained 5 lb. of such ore that yielded $25, and the entire sample is reported to have assayed $250 per ton. A drift 700 ft. long on the "E" vein shows a length of 279 ft. of ore averaging, I am told, 10 in. thick. A 1-in. band of this ore runs $8 per pound.

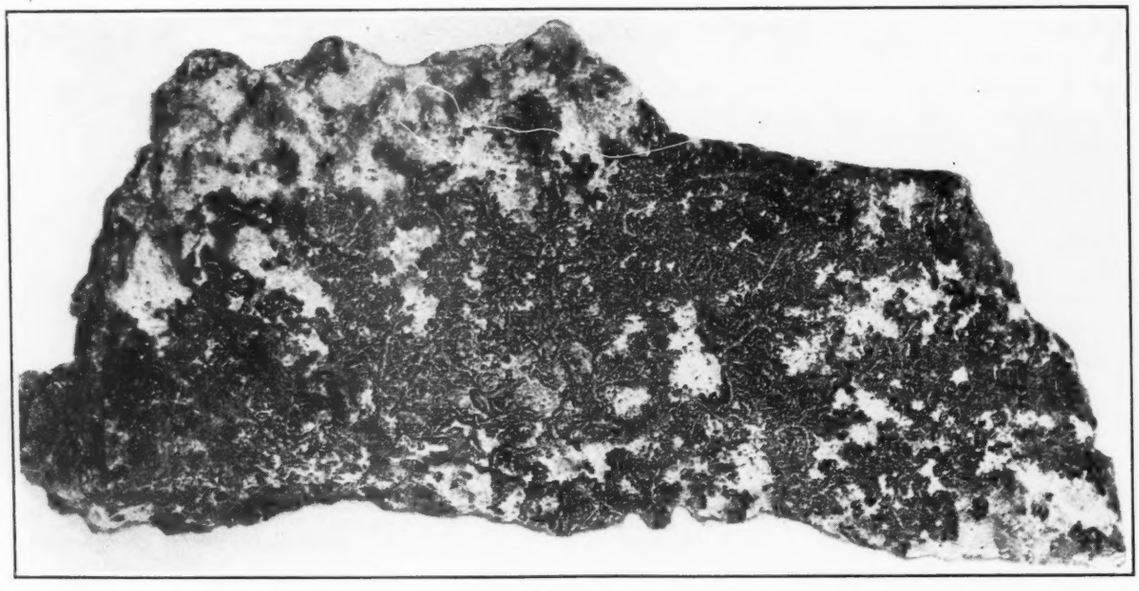
The genesis of this rich gold ore is as unusual as its character. Both field work and study under the microscope show that the veins record three distinct and successive periods of fracture and mineralization.

The *earliest fissuring* and mineralization produced a multitude of very small veinlets of chlorite.

In the *second and most important period,* intense brecciation occurred in zones opened both along the earlier fractures and transverse to them. Slivers of the older chloritic vein filling became detached and floated in vein quartz, calcite, and albite, which in places filled the fissures and crush zones. The calcite had probably been absorbed by the vein magma as it came up through the deeply underlying carboniferous limestone.

This period was the main or principal time of vein formation and all the quartz veindikes are attributed to it; but the only metallic minerals positively attributable to it are metallic arsenic and antimony.

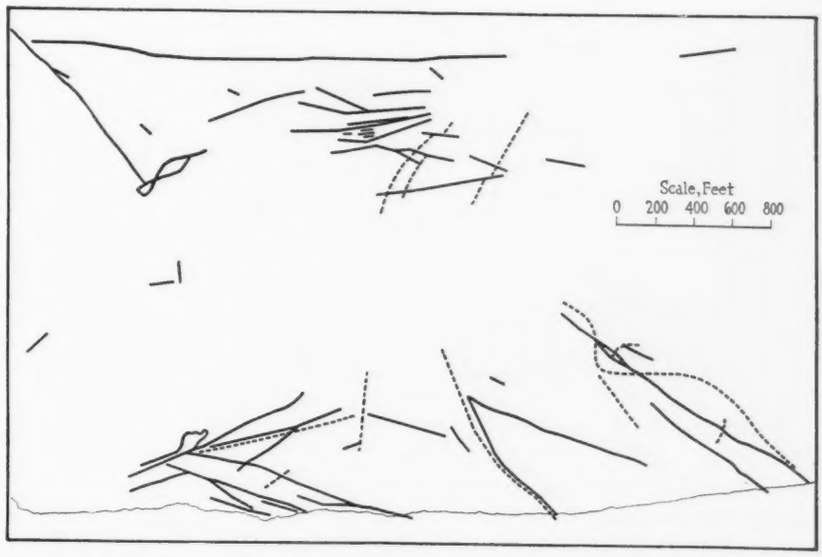
The veindikes fill or partly fill fissured zones for stretches varying from a few yards up to several hun-



Rich gold ore, Engineer Mine. Curly gold threads in roscoelite mass (dark). White is quartz

Dikes and Veins of Engineer Mine

Details showing their relation to each other taken from plan of workings. Full lines represent the veins and broken lines the dikes. At the bottom is the shore line of Taku Arm.

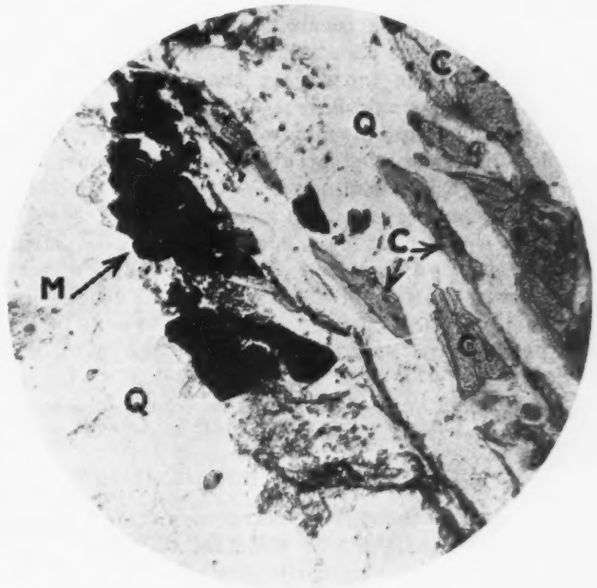


dred feet along one shear zone. The vein quartz often contains innumerable fragments of the tuff and slate wall rock, partly altered, wholly altered, or so completely absorbed by the quartz that only the structure of the argillite, shown in dark coloring matter, remains as a ghost of the former fragment. The quartz (coarsely crystalline and white) is the predominant and sometimes the only mineral seen in the veindikes; but in the richer gold-bearing veins, lenses and masses of calcite occur which vary from pure calcite to a mixture of calcite, quartz, and feldspar. The feldspar, which is albite (largely altered to sericite), occurs in short crystals often 3 in. or more in diameter, entirely surrounded by a quartz-calcite matrix. The calcite in this vein filling sometimes contains shelly conchoidal masses up to 6 in. across, composed of native arsenic and antimony, or the mixture known as allemontite, these metals occurring particularly where feldspar occurs.

The quartz-feldspar-calcite magma solidified and was then fractured and altered by a third period of movement and mineralization. The earlier vein matter was cracked and in places shattered; the new solutions penetrated capillary and subcapillary fractures of the earlier quartz, and cleavage planes of the calcite and feldspar crystals, depositing gelatinous silica, a dusty coating of tiny stibnite needles, and sometimes arsenopyrite. The replacement of calcite at first formed rhomboidal quartz "boxes" of plates deposited along cleavages; later, as the calcite dissolved, the silica filled the "boxes" in the manner described by Lindgren at the De Lamar mine, Idaho.

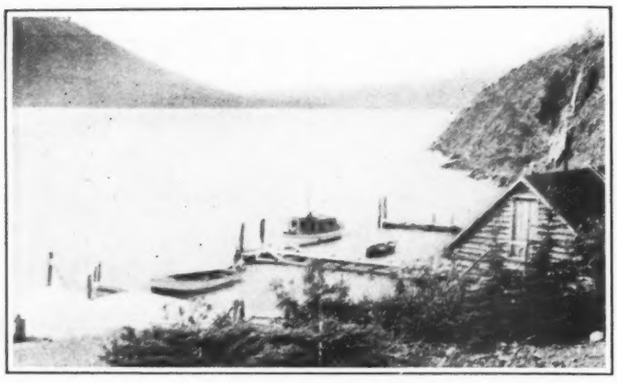
This *third period* of injection was the most important one commercially. Many of the quartz veins (more especially the smaller ones) were completely changed by this later or third period of fracture and mineralization, which closely followed the solidification of the earlier vein fillings. In this new period, magmatic solutions apparently of quite different character from the earlier ones ascended through the vein and altered and replaced the calcite and feldspar of the immediately earlier period. These solutions altered the chlorite, replaced the calcite, formed roscoelite by reaction with chlorite and other minerals, broke down the feldspar crystals into patches of sericite, and converted the former carbonate into colloidal silica, soon changed to quartz or the quartz-roscoelite mosaic which now carries the gold.

The deposition of the gold and its associated minerals took place in a substage or late phase of the third period of mineralization, when the hardening of the siliceous "gel" and its conversion into quartz caused the formation of tiny shrinkage or contraction cracks, strain fissures, in the veindike jelly. These occur both in the quartz alone and where quartz is intergrown with roscoelite, but the gold is largely, though not entirely, confined to the tiny fractures, crisscrossing this vanadiferous material. It appears evident that the gold-bearing solutions were an end stage emanation product of a differentiated igneous magma. The gold found in these contraction fissures, and rarely in detached masses in the quartz, is 55 per cent gold and 45 per cent silver, a gold alloy worth about $14 an ounce. In the veinlets the gold forms plates and crystalline, fernlike masses associated and intergrown in some parts of the veinlet with arsenopyrite, stibnite, quartz, and ankerite, and rarely with tetrahedrite and minute quantities of zinc



Photomicrograph of vein matter taken in ordinary light, magnification about 35 diameters

Detached slivers of the older chlorite vein filling (*C*) swamped in vein-quartz of the second period (*Q*). Some of the slivers are replaced by pyrite, pyrrhotite, and gold (all black in this light—*M*). The chlorite has, by reason of its greater ease of replacement, acted as one of the loci of deposition for the metallics.



Landing at Engineer Mine, on Taku Arm

blende. The way these minerals fill the tiny fissures and penetrate the walls is conclusive evidence of both filling and replacement.

The specimens show that the solutions of this period attacked the feldspar, dispersed it into patches of sericite or changed it to roscoelite. At the same time the native antimony and arsenic were largely changed to sulphides; wherever these native metals are found, the replacement is incomplete. That there has been resorption of the chlorite and of the roscoelite is clearly indicated by both hand specimens and by microscopic study, as thin gold plates isolated in quartz appear to have been formed in this way. The older chlorite veinlets and the strongly chloritized remnants of argillite seem to have excited a more or less selective precipitating action on the gold. The most striking fact connected with the occurrence of the gold is, however, in its constant occurrence with the vanadium mica. So far as known it is a positive indicator of rich ore, and where the roscoelite is abundant the gold is also abundant.

The factors controlling the deposition of the gold appear to be: (1) ease of replaceability of chloritic slivers and of the vanadium mica; (2) mineralization in minute fissures whose occurrence and character show them to be shrinkage cracks in a crystallizing vein mass of a more jelly-like consistency than ordinary hydrothermal solutions would have; (3) replacement of some former ferromagnesian mineral like hornblende, for example—areas occupied by gold seeming to have outlines of some original mineral.

Under the microscope the gold is clearly seen to replace the spherulitic mica, cutting it and penetrating it along cleavage lamellæ. The tiny veinlets show arsenopyrite, quartz and ankerite, stibnite needles and tetrahedrite, as well as gold. Gold also occurs in isolated patches and stringers in which the associated minerals have been dissolved and absorbed. The last minerals formed in vugs of the vein are ankerite, quartz, and a little calcite.

Ores Due to Magmatic Differentiation

The evidence disclosed by petrographic study shows that the source of the gold and that of all the other mineralization was magmatic; and that the metallic minerals, as well as the quartz, are end-stage or later products of a differentiation of the same magma that formed the accompanying dike rocks.

Native arsenic and antimony are no longer regarded as of positive shallow deposition, and roscoelite is a mineral found in the gold veins in California which belong to the deep vein zone. Arsenopyrite and stibnite have a wide range of occurrence vertically. It appears, therefore, that evidence does not warrant the conclusion that these veins belong to the superficial or shallow seated type, as suggested by the bonanza character of the ore. Where the veins are not covered by glacial clay or debris, oxidation has attacked the sulphides and also the chlorite and roscoelite, and the vein is somewhat rusty, porous and mostly leached of its gold. Hence the lean veins of white quartz are conspicuous, while the rich veins are both small and inconspicuous, and the gold largely leached. Therefore prospectors may do well to look for brownish quartz pseudomorphic after calcite as one factor warranting work enough to get down to unoxidized material; if green quartz, stained by either roscoelite or mariposite, is found, free gold is likely to be near by.

The mine is now under active development, a crosscut tunnel nearly 2,600 ft. long cutting seven or eight of the richest veins at depths of 250 to 500 ft.

Face Value, Weight, Fineness, and Silver Content of the Principal Silver Coins*

By H. N. Lawrie
Washington, D. C.

Country	Coin C	Face Value in Cents	Total Weight in Grains	Fineness Parts in 1,000	Fine Silver Contents in Grains
Argentina	Peso	96.48	385.8089	900	347.2280
Australia	Shilling	24.33	87.2727	925	80.7273
Austria	Schilling (new)	14.07	92.5941	640	59.2602
Belgium	Franc	19.29	77.1618	835	64.4301
Bolivia	Boliviano	38.93	308.6472	833⅓	257.2059
Brazil	Milreis	54.64	154.3235	900	138.8912
Brit. E. Africa	Shilling	24.33	120.0000	250	30.0000
Bulgaria	Lev	19.29	77.1618	835	64.4301
Canada	Dollar	100.00	360.0000	800	288.0000
Chile	Peso	36.50	138.8912	500	69.4456
China	Dollar (Yuan)	66.87	414.4622	890	368.8716
Colombia	Peso	97.33	385.8089	900	347.2280
Costa Rica	1-Colon (new)	25.00	154.3236	500	77.1618
Costa Rica	2-Colon (old)[1]	50.00	308.6471	900	277.7824
Cuba	Peso	100.00	412.4992	900	371.2500
Danzig	Gulden	19.47	77.1618	750	57.8713
Denmark	Krone	26.80	115.7427	800	92.5941
Egypt	20-Piaster piece	98.86	432.1060	833⅓	360.0883
Finland	½-Markka	9.64	39.3432	750	29.5082
Finland	Markka	19.29	79.9836	868	69.4255
France	1-Franc piece	19.29	77.1618	835	64.4301
France	5-Franc piece	96.48	385.8089	900	347.2280
Germany	Mark (old)	23.82	85.7340	900	77.1618
Germany	Mark (new)	23.82	77.1618	500	38.5809
Great Britain	Shilling (old)	24.33	87.2727	925	80.7272
Great Britain	Shilling (new)	24.33	87.2727	500	43.6364
Greece	Drachma	19.29	77.1618	835	64.4301
Guatemala	Quetzal	100.00	514.4119	720	370.3765
India	Rupee	48.66	180.0000	916⅔	165.0000
Italy	Lira	19.29	77.1618	835	64.4301
Japan	50-Sen piece	24.92	76.3902	720	55.0009
Lithuania	1-Lit piece (new)	10.00	41.6674	500	20.8337
Lithuania	5-Lit piece (new)	50.00	130.2105	800	104.1684
Mexico	Peso	49.85	257.2059	720	185.1882
Netherlands	Florin	40.20	154.3236	720	111.1130
Nicaragua	50-Centavo piece	50.00	192.9044	800	154.3236
Nicaragua	Cordoba	100.00	385.8089	900	347.2280
Norway	Krone	26.80	115.7427	800	92.5941
Persia	Kran	9.99	71.0351	900	63.9316
Peru	Sol	48.66	385.8089	500	192.9044
Philippine Is	Peso	50.00	308.6471	800	246.9177
Poland	¼-Zloty piece	9.65	38.5809	720	28.9357
Poland	Zloty	19.29	77.1618	720	57.8713
Poland	2-Zloty piece	38.58	154.3236	720	115.7427
Poland	5-Zloty piece	96.48	385.8089	750	347.2280
Portugal	Escudo	108.06	385.8089	835	322.1504
Russia	Rouble (new)	51.46	308.6472	900	277.7824
Siam	½-Tical	20.27	115.7427	650	75.2327
Siam	Tical	40.54	231.4853	900	208.3368
Straits Settlements	Dollar	56.78	260.0000	500	130.0000
Sweden	Krone	26.80	115.7427	800	92.5941
Switzerland	Franc	19.29	77.1618	835	64.4301
Turkey	10-Piaster piece	43.97	185.6127	830	154.0581
Union of S. Africa	Shilling	24.33	87.2727	800	69.8182
United States	Dime	10.00	38.58	900	34.7220
United States	Quarter	25.00	96.45	900	86.8050
United States	Half Dollar	50.00	192.90	900	173.6100
United States	Dollar	100.00	412.50	900	371.2500
Uruguay	Peso	103.42	385.8089	900	347.2280
Venezuela	Bolivar	19.29	77.1618	835	64.4301
Venezuela	5-Bolivar piece	96.47	385.8089	900	347.2280

* Compiled and computed from data as of June 1, 1925, from official foreign and domestic sources, including the U. S. Bureau of the Mint and the Bureau of Foreign and Domestic Commerce

[1] The old 1-colon piece restamped 2-colon

The El Paso Smelter

A Description of the Lead and Copper Plant of the American Smelting & Refining Co.

By George J. Young
Associate Editor

THE EL PASO SMELTER, situated at El Paso, Tex., and operated by the American Smelting & Refining Co., serves the mining districts of Chihuahua, Mexico; Arizona and New Mexico. The National Railroad of Mexico to the south, the Santa Fé railroad to the north, and the Southern Pacific easterly and westerly, make El Paso a railroad and business center. There are no mines close to El Paso and practically all ore that is treated at the El Paso smelter is transported over the railroads for considerable distances, so there is not a great justification for El Paso as a site for a custom smelter. Nevertheless, a considerable volume of ore reaches this railroad center from Arizona, New Mexico, and Mexico, and by reason of the fact that the smelter has been established for a long time a comparatively stable business has resulted. Two types of ore—copper concentrate from Chino, and lead ores, principally from the Ahumada-Erupcion mines—are handled, and in addition miscellaneous lead, copper, gold, and silver ores. The total present smelting charge exceeds 2,000 tons per day.

The smelter was started in 1883, its principal business at the time being the treatment of lead ores, and this continued to be so for a number of years. In 1910, copper-smelting equipment for the treatment of the Chino concentrate was installed. The Chino concentrate, high in iron and sulphur, furnished the basic material for smelting miscellaneous siliceous copper and oxidized ores. Before this period a copper blast furnace had been added, but a converter was not installed and the copper matte was shipped to Aguascalientes, Mexico. The business was not especially profitable. The development of Chino came at a critical time and resulted in rejuvenating the El Paso smelter.

In 1912, the copper-smelting equipment consisted of two reverberatories, 19x100 ft., and four three-hearth Wedge roasting furnaces. At the time Chino concentrates contained comparatively little sulphur, the Wedge furnaces being used principally for drying and not especially for sulphur elimination. When Chino encountered heavy sulphide ores, two additional hearths were added to each Wedge roaster to increase the sulphur elimination and four additional furnaces (Wedge) were built. The grade of the concentrates dropped and the tonnage increased. This made necessary the building of additional facilities. Four seven-hearth roasting furnaces were added, a 1,000-ft. flue and a 400-ft. stack. In addition two reverberatories, one 26 ft. inside width and another 28 ft., were constructed. This was done during the war and in response to the demand of the time. Two additional copper blast furnaces were added, but the copper blast furnaces were finally abandoned, as the principal iron and sulphur required in the smelting were contained in the Chino concentrate and it was more economical to crush the lump ore and mix it with the concentrate.

The slump in copper mining after the war seriously affected the plant. With the resumption of copper-mining operations the tonnage of Chino concentrate declined from 1,000 tons per day to 400 tons. In addition conditions had changed at Chino and the concentrate was higher in grade and contained less iron and sulphur. This condition has been maintained, but the quantity has been increased. Thus the history of the plant reflects widely fluctuating conditions in both ore supply and composition of ores. The development of Ahumada increased the importance of the lead-smelting division, and now both copper and lead ores are about equal in volume. The Ahumada ore consists principally of lead sulphate associated with gypsum and containing considerable iron and less than 1 per cent silica. Although rich in lead and silver, the ore is not easy to smelt and presents a new series of problems. Nevertheless the smelter has prospered under the able business management of Kuno Doerr, who assumed the direction of the company's operations in 1912.

The plant, on the western edge of El Paso, close to

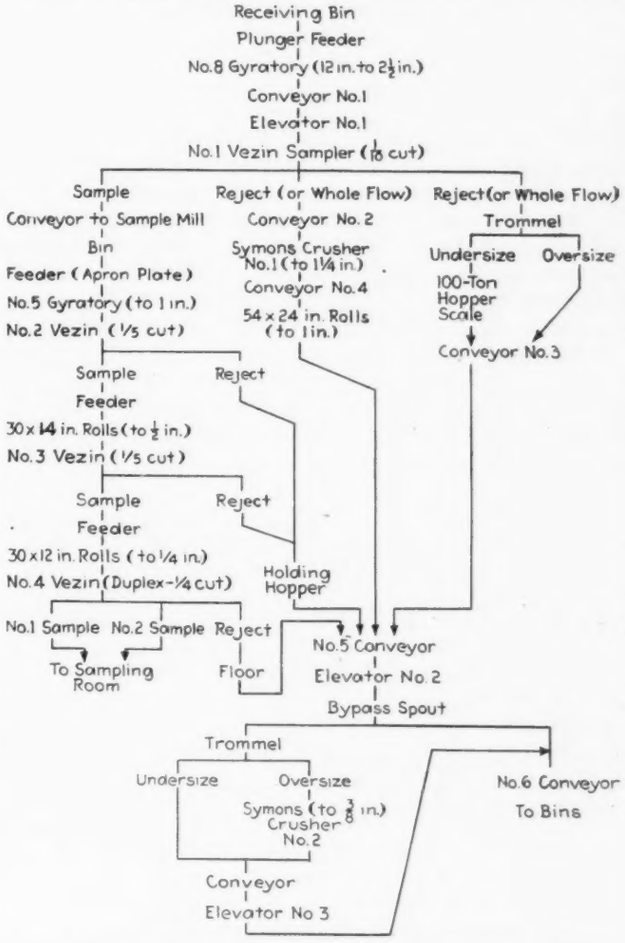


Fig. 1—Flow sheet of sampling, coarse- and fine-crushing plant

ceive their feed on the same level as the blast-furnace charging floor. The blast-furnace charging car locomotive pushes a charge car over the grating covering the hopper-bins leading to the roasters and discharges its load into the bins. The sintering machines are oil fired and discharge into hand-buggies, by which the sinter is moved to the blast-furnace charging pit. The feeders to the machines are of the revolving plate type, a plow scraping off the material into the feed spout. A water-spray pipe discharges upon the conical heap on the feed plate. Sulphur in the charge is reduced from 8 to 3 per cent.

The six blast furnaces, each handling 200 tons of charge per day, are arranged in parallel. The design of the furnace is shown in Fig. 3. The furnace top is of the type designed by Philip S. Morse, and is called the Australian top. The charge car used is a modified design of the Pueblo charge car. It is arranged with two bottom-discharge hoppers on a common truck. The furnace top was originally equipped with end spreaders, but these were removed and the hoppers on the car are designed so as to admit of movement back and forth sufficient to command the ends of the furnace. In

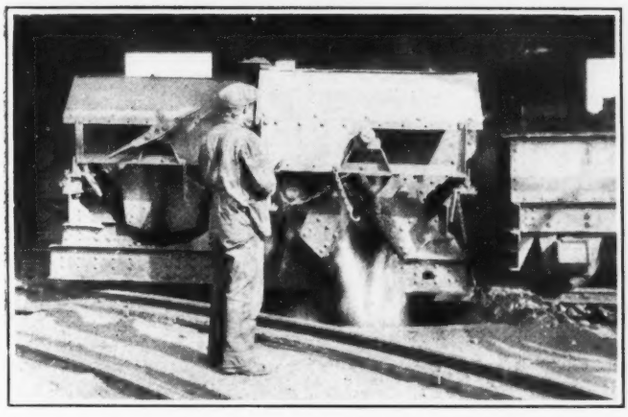


Fig. 4—Lead blast-furnace charging car and electric locomotive. The car is shown discharging into the top of the blast furnace

operating the car, it is shunted over the furnace top and the hopper shifted to the end of its travel and dumped as shown in Fig. 4. In this way the charge is dumped in the four quadrants of the top.

The slag and matte discharge is at the end of the furnace, where it is received in two forehearths placed in tandem. The forehearths are mounted upon trucks and are placed on a separate track in line with the axis of the furnace. Another track, depressed at the side of the forehearth, is used for the matte car, and still another track at a higher level (Fig. 5) serves to hold spare forehearths and extra slag cars. The slag cars are of 160-cu.ft. capacity and are of the motor-tipped type. Tracks are 36-in. gage and steam locomotives are used to handle the slag to the dump. The front of the furnace at the tapping end and the forehearths are covered with hoods, which are connected to stacks extending above the roof as shown in Fig. 5. Charge cars are loaded in a pit by hand-buggies, which are operated on the bedding-floor level. They are then shunted by locomotive to two hydraulically operated elevators (Fig. 6) and taken to the furnace charging floor.

Lead from the lead wells of the furnace is tapped

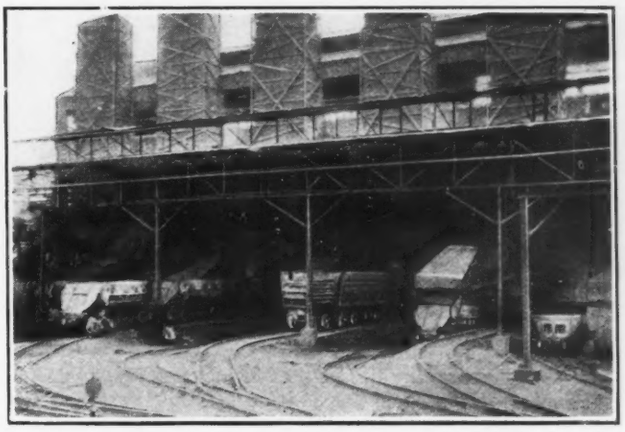


Fig. 5—Trackage arrangements at tapping level of lead blast furnaces. Note hoods and stacks over forehearths and tapping end of furnace

into small ladle cars and transferred to three 40-ton drossing kettles, oil fired. From these pots the lead is pumped to a casting machine of the straight-line type, the lead pigs being delivered automatically by a gravity conveyor (Fig. 7) to cars for shipment to Perth Amboy and Omaha. The dross skimmed from the kettles is treated on two sweating furnaces of simple construction. The furnace is of rectangular shape, constructed of low brick walls supporting a curved iron pan perforated with holes. The lead is caught by an iron launder and run into molds. The furnace is oil fired.

Roasting equipment for handling copper concentrates is placed in two separate buildings, one housing four seven-hearth Wedge roasters 22 ft. 2 in. in diameter and the other housing eight five-hearth roasters 22 ft. 6 in. in diameter. All roasters are placed higher than usual to facilitate access beneath. Larry cars hauled by trolley locomotive transport the calcines to the reverberatories. The capacity of the seven-hearth furnace is 200 tons per day and of the five-hearth, 120 tons per day. Rabble speeds vary from 16 to 80 r.p.hr.; depth of ore on hearth, 6 in.; hearth construction, brick with a few concrete hearths; oil fuel is used for auxiliary dust; flue dust is returned by an air lift to the third hearth below the drying hearth; maximum temperature of roasters, 1,000 deg. F., and temperature of discharged calcines, 800 deg. F. Five men per shift

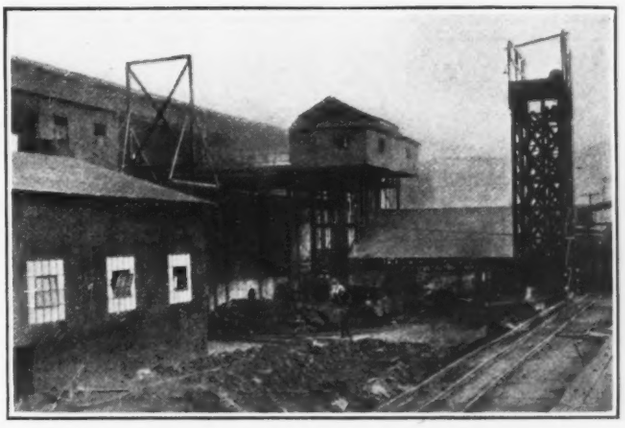


Fig. 6—Charging pit and elevators lifting charge cars to the charging floor of the blast furnaces

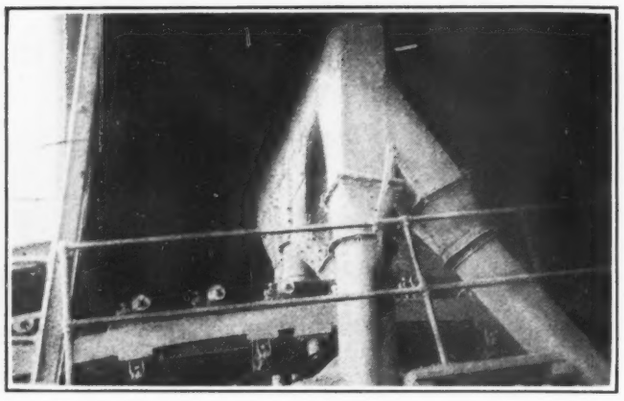


Fig. 2—Spout system receiving discharge from No. 6 belt conveyor and delivering to bins or to belt conveyor to other bins

the Rio Grande, consists of two smelting divisions, a lead blast-furnace plant and a copper reverberatory and converter plant. These are in parallel and there is little interrelation. Part of the copper-converter flue dust is handled in the lead-ore briquetting plant and sent through the lead blast furnaces, and leady copper matte is finally treated in the converters. Apart from this the two divisions are separate. Power, sampling, crushing, and control of operations, as well as maintenance and transportation facilities, are used in common.

Ore storage is provided in bedding floors (for blast-furnace charge), a concrete bin of 12,000 tons' capacity, a briquet drying yard, and a concentrate yard where excess receipts of copper concentrates are stacked. Coke is stored in a part of the concrete bin. Fuel-oil storage for the reverberatories is provided by tanks. The concentrate yard is served by a Brownhoist locomotive crane, which is used for unloading to the stock pile and reclaiming copper concentrate when wanted by the smelter. The ore bins are served by a pair of overhead tracks, between which is a 36-in. belt conveyor upon which concentrates are shoveled from the cars. This delivers by a tripper to the bins on either side.

A coarse- and fine-crushing unit with accessory sampling equipment is placed close to the ore bin. The flow sheet is shown in Fig. 1. The crushed product is taken by a belt conveyor, which discharges into a distributor (Fig. 2). This delivers to the bins by a series of spouts or to a central upper belt conveyor, which delivers to a tripper discharging to the bins along its length. The arrangement of the crushing and sampling installation is elastic, permitting ores to be mechanically sampled, or coarse crushed, or fine crushed to $\frac{3}{8}$-in. size and delivered to the appropriate bins.

Beneath the 12,000-ton bin, which is divided into various compartments, are two lines of belt conveyors served by movable hoppers; one conveyor delivers to an inclined conveyor leading to the copper-concentrate roasting furnaces and the other delivers ore and coke to the lead blast-furnace charge cars. The arrangements have not been completely worked out, as the intended plans were changed when the armistice was signed and war conditions terminated.

In addition to the ore-crushing unit, another crushing unit is provided for handling leady matte. This consists of a gyratory crusher, bucket elevator, screen and rolls, the roll product being returned to the screen by the bucket elevator. This crushing unit is placed at a point convenient to the charge-car loading point.

The briquetting plant is equipped with a bucket elevator discharging upon a screen, the undersize being received into a bin. The fine material is mechanically fed to a trough mixer, where it is mixed with slaked lime and delivered to a two-plunger Chisholm press, which discharges the briquets upon a belt conveyor. The briquets are stacked and removed by trucks to the drying yard. From this yard they are reclaimed by trucks and sent to the blast-furnace charging pit.

Certain ores are unloaded from the cars at the ore beds and are shovel sampled, every tenth shovel being retained for the sample. Coarse lump ores are sent to the crushing unit and mechanically sampled. Copper concentrates are sampled by reserving every tenth shovel when they are unloaded. Mixed flotation and table concentrates in the proportion of one to one can be handled satisfactorily without special equipment. Excessively wet concentrates are unloaded in the concentrate yard by bucket and after drying out are reloaded and sent to the bins. The different products from so many sources, the large number of lots, and particularly the many different types of railroad cars in which ores are received makes impossible any great refinement of methods in obtaining the preliminary sample, but all samples are worked down under the usual conditions of careful handwork. Mechanical sampling (Vezin type) is practiced entirely for all ores handled through crushing mill No. 1. This includes all copper ores and more than half of the lead ore.

Three Dwight-Lloyd sintering machines, each handling 150 tons of charge per day, are placed in a prolongation of the lead blast-furnace building and re-

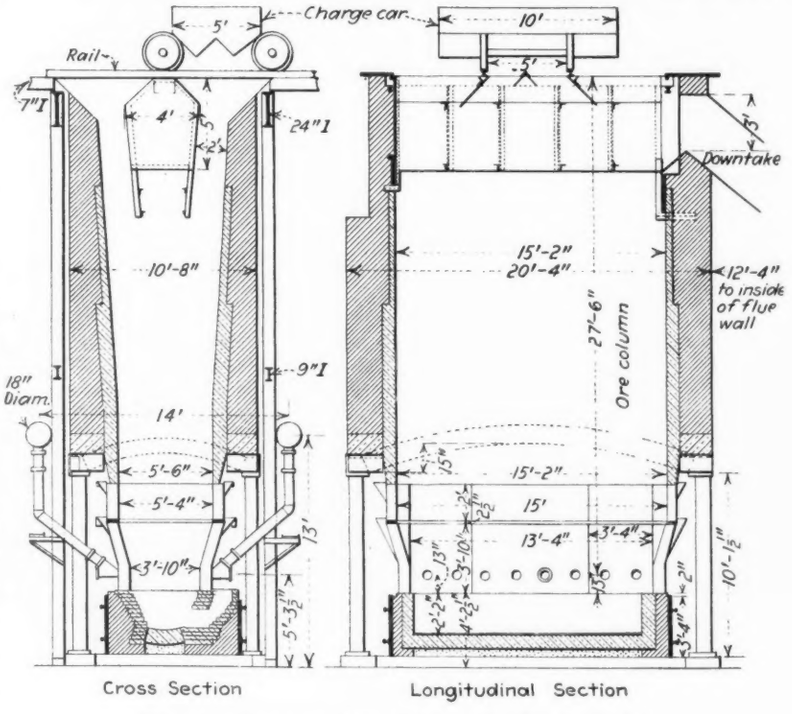


Fig. 3—Cross-section and longitudinal section of lead blast furnace

distributed at the top of the stack, a type of stack top that has proved to be of no special value. The stack is of concrete and is lined for one-third of its height inside with one course of brick laid in acid-proof mortar, as well as painted above the lining with silicate of soda and similarly painted on the outside for a distance one-half the height from the top. The converter flue is served by a single track and car, which dumps into a small bin.

Electric power in the form of direct and alternating current, compressed air under high pressure, converter air for converters and burners, blast-furnace air, and high-pressure water for elevator operation, is provided by the power plant, which is centrally placed and derives steam from the waste-heat boilers of the reverberatories. The principal units are as follows:

1 Hamilton tandem-compound engine, 350 hp., 16x32x36 in. direct connected to a No. 10 Connersville blower.
1 Nordberg cross-compound engine, 15x30x36 in., direct connected to a G.E. generator supplying 1,000 amperes at 250 volts, d.c.
1 Nordberg cross-compound steam engine direct connected to a G.E. d.c. generator, 1,600 amperes, 250 volts.
2 Nordberg cross-compound blowing engines, one 750 hp. and the second 1,000 hp.
2 Allis-Chalmers turbo-generators, each 500 kw.
2 Ratteau, Battu, Smoot & Co. turbo blowers, one supplying air under 5-lb. pressure and one at 14-lb. pressure.
Accessory pumps, compressors and condensers; cooling pond for condenser water.
Plate, blacksmith, locomotive, machine, electrical repair, and welding shops are maintained for repair work.

Lead-Smelting Practice

The Ahumada-Erupcion lead ore, which consists of anglesite (lead sulphate) associated with a considerable proportion of gypsum, iron oxides, and very little silica, contains a large amount of fines. The screenings of

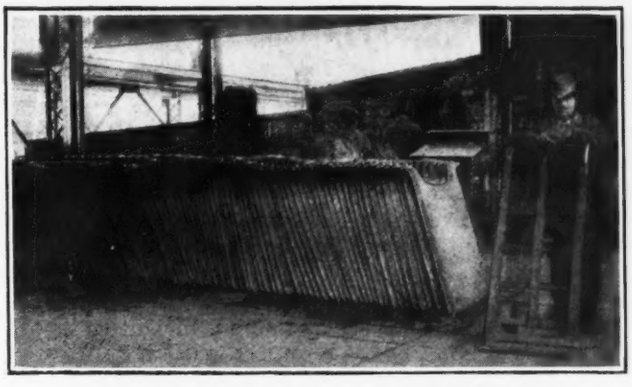


Fig. 10—Copper anodes stacked on shipping floor

the ore from this source amount to 70 per cent of the total weight of ore. As much of the fine material as possible is sent to the Dwight-Lloyd sintering machines and the excess is briquetted along with the flue dust from the blast furnaces and the sintering machines. The mixture makes a hard, compact briquet (Fig. 13), admirably suited for blast-furnace operation. Most of the ores treated in the blast furnace are not bedded. Bedded ores constitute 25 per cent of the ore charge and the remainder, amounting to about 500 tons per day, is gravity-bin material. Although this is not a satisfactory arrangement from a metallurgical viewpoint, it has proved feasible. The Dwight-Lloyd machines reduce the 8 per cent of sulphur in their charge down to 3 per cent. Leady matte constitutes 2 per cent of the sintering furnace charge.

The lead content of the charge is 14 to 15 per cent; coke 14½ per cent, and scrap iron 1 per cent. Coke is obtained from Cokedale, Colo., the coal properties being

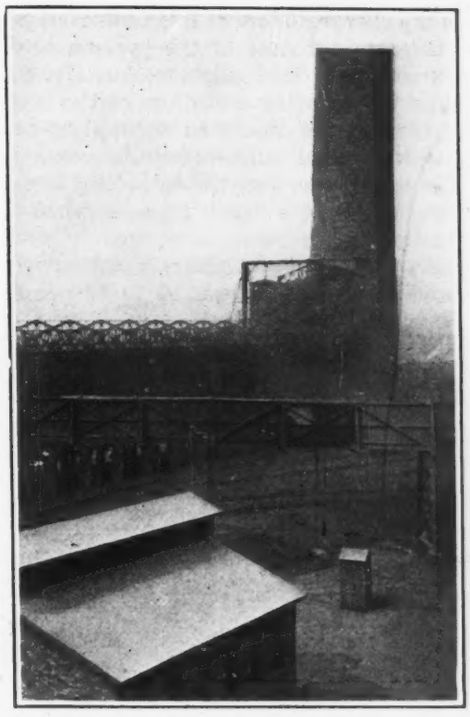


Fig. 11—Reverberatory and roaster flue and stack; note trusses used to carry the roof

a subsidiary of the A. S. & R. Co. The daily charge is 1,000 tons, including limestone but not secondaries. The matte fall is 10 per cent of the charge. Matte is poured out on the ground; when cooled it is broken up, and after crushing is sent to the Dwight-Lloyd sintering machines. The leady matte is sent two or three times through the blast furnaces and when it reaches a copper content of 20 per cent, a blast furnace is used temporarily for a matte concentration run and the final matte sent to the copper converters.

The lead blast-furnace slag averages 30 per cent silica, 39 per cent ferrous and manganous oxides, 20 per cent lime, 3½ per cent alumina, and 4 per cent zinc. The ores are noticeably free from zinc. The endeavor is made to maintain the lime in the slag equal to 70 per cent of the silica, but the high proportion of gypsum in the charge makes it difficult to keep the lime as high as desired and tends to make a mushy slag resembling a slag high in zinc. The result is a higher coke require-

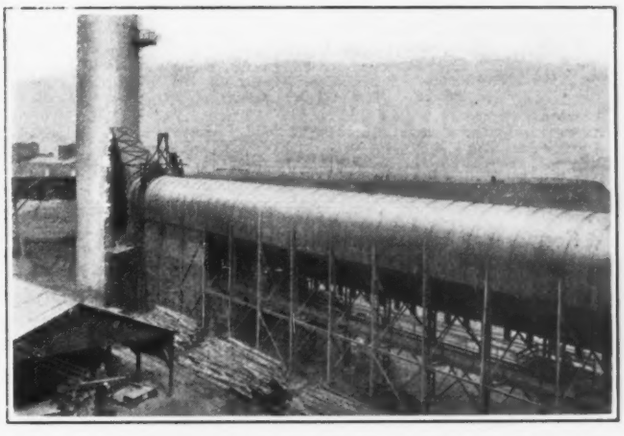


Fig. 12—Converter flue and stack; note gas-sampling platform on stack

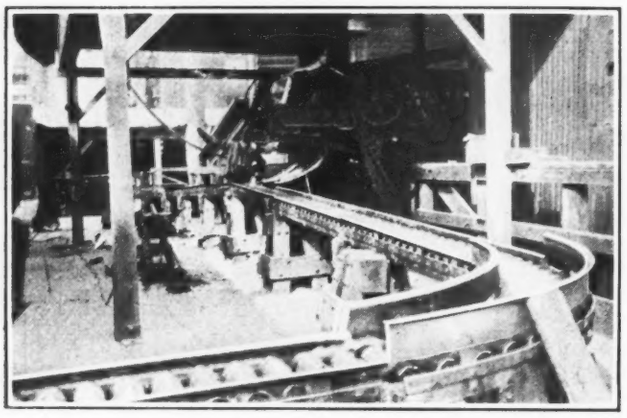


Fig. 7—Straight-line casting machine and gravity conveyors for handling pig lead

are required to operate the four seven-hearth roasters. The roasters connect with the main flue serving the reverberatories. (Fig. 8.)

The two reverberatories in active use have the following dimensions:

	No. 3	No. 4
Area of hearth, sq.ft.	2,750	3,340
Length of hearth, ft.-in.	116—9	126—6
Maximum width		
At firing end, ft.	25	27
At flue end, ft.-in.	11—9	14—0
Height of roof		
Above hearth, ft.-in.	9—9	9—9
At firing end	9—9	9—9
At flue end	4—6	4—6

The Steptoe type of burner is used, six burners being provided for each furnace; oil outlet, ⅜ in.; air outlet, 3 in.; air under 13-lb. pressure, using the same supply as the converters. Three Erie vertical boilers, 600 hp. each, are provided for each reverberatory; size of flue leading from furnace is 7 ft. by 12 ft. 5 in. The temperature of gases at the firing end is 2,900 deg. F.; at flue end, 2,200 deg. F.; and beyond boilers, 700 deg. F. The labor per shift for each furnace is six men. Slag is tapped intermittently at the end of the furnace into slag cars upon a lower level. The matte tap is at the side near the slag end, the matte being laundered to the converter aisle. Ore charging is by the usual overhead hoppers.

Three converters are provided, two of the Peirce-Smith type, 13x33 ft., and one of the Great Falls type, 12 ft. in diameter, not in active use. The Peirce-Smith converters have been in use for eight years. The

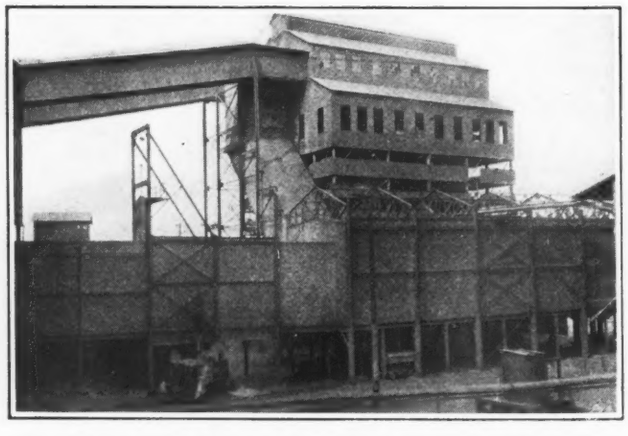


Fig. 8—Wedge roasters and connecting flues

tuyères are forty-two in number, each a 1¾-in. steel pipe, and the line of tuyères is 3 ft. below the center line. The blast pressure is 14 lb. per sq.in. and approximately 20,000 cu.ft. of air per minute is taken by each converter. Siliceous material is charged into the converters by a Garr gun placed at the end of the shell and receiving its supply from a bin at a higher level (Fig. 9). Cleanings from the floor are charged by boats handled by the crane. The converter offtake is of simple construction and consists of a cover on wheels, from which is suspended a vertical curtain. The side walls provide an inclined runway for the cover. By hauling the cover up, the converter mouth is made accessible, and by lowering it, the converter is closed in for blowing. This is shown on the right-hand side of Fig. 9. The converter aisle is served by two traveling cranes. Reverberatories are placed on one side,

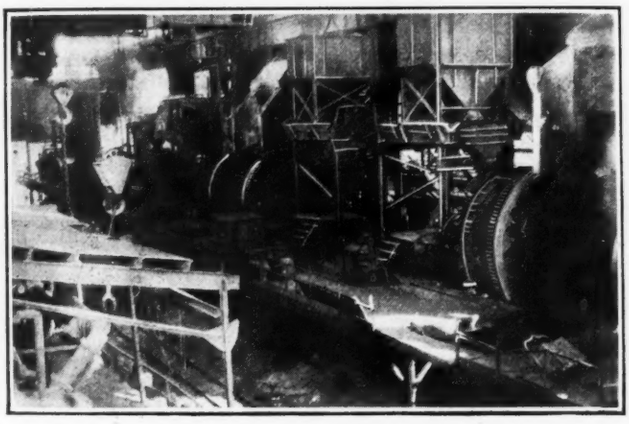


Fig. 9—Converter aisle, showing flux-charging hoppers and uptake flues

and converters, holding furnaces and skull breaker on the other. The skull bin discharges directly into cars beneath. Two revolving oil-fired holding furnaces are provided at the opposite end of the converter aisle. These serve a circular-type Walker anode casting machine. Directly in front of the casting machine are three quenching tanks. The anodes are lifted from the molds by a ½-ton Whiting crane and placed in the quenching tank, from which they are lifted in groups of ten each by a 15-ton Shaw traveling crane and placed on edge upon the copper shipment floor (Fig. 10).

The lead blast-furnace flue is 900 ft. long and 15x25 ft. in section; of brick construction with arched roof. It is provided with hopper bottoms. The blast-furnace stack is 225 ft. 6 in. high and 14 ft. in diameter at the top. The reverberatory and roaster flue (Fig. 11) is 955 ft. long by 33½ ft. wide and 26 ft. high. The roof is carried by overhead trusses and the side walls by girt plates attached to the columns. Walls and roof are constructed of brick. The bottom is provided with three lines of hoppers, which are served by a like number of tracks on a 1.5 per cent grade in favor of the loading cars. The stack is 400 ft. high and 30 ft. in diameter. It is constructed of hollow tile. The converter flue (Fig. 12) is of the balloon type, steel construction, and with a cross-sectional area of 101 sq.ft. It is 540.5 ft. long and is provided with arc-gate outlets at the bottom, 5 ft. center to center, along its length. The converter stack is 300 ft. high and 16 in. in diameter. It is provided with a Wislicenus top, which consists of a number of small openings, radially

ment in the charge. More or less controversy has arisen as to the exact behavior of the gypsum in the charge in the presence of lead sulphate, but it would appear that under the reducing conditions of the blast furnace, part of the gypsum would be reduced to calcium sulphide, which would subsequently increase the matte fall. The dross from the casting kettles is accumulated and run through the blast furnace when the matte concentration run is made.

Roasters reduce the sulphur in the copper concentrates and roaster feed from 17 to 14 per cent. The

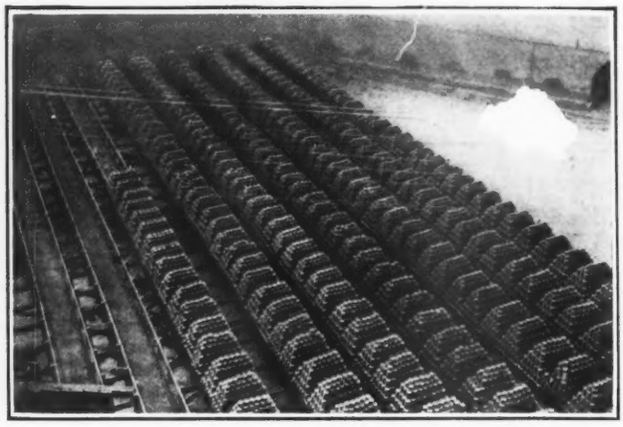


Fig. 13—Briquet drying yard. The briquets are placed on frames that enable the trucks to pick them up as required without disturbing the pile

dust from the roasters and reverberatories is returned to the roasters. The reverberatory solid charge, consisting of hot calcine, amounts to 800 tons per day, including secondaries. In addition, 150 tons per day of converter slag is sent to the reverberatories for cleaning. Limestone flux amounts to 25 tons, and fettling ores to 10 tons. The calcine is delivered at a temperature of 900 deg. F. The depth of the liquid bath in the reverberatory is 43 in. at its maximum and 40 in. as an average. The draft gage registers 0.05 in. water for the reverberatory and 0.45 to 0.50 in. beyond the waste-heat boilers. The chemical composition of the charge, matte, and slag is given in the accompanying table. Fuel oil is 24 deg. Bé. and the ratio is between 0.5 to 0.6 bbl. of oil per ton of charge.

Analyses of Reverberatory Charge, Matte, and Slag

	Copper, per Cent	Silver, Oz. per Ton	Gold, Oz. per Ton	Iron and Manganese, per Cent	Sulphur, per Cent	Silica, per Cent	Lime, per Cent	Alumina, per Cent
Average in charge	19.5	3.0	0.01	25.0	2.73	17.0	4.0	5.9
Average in matte	41.0	6.3	0.02	32.6	24.9	0.4	...	...
Average in slag furnace sample	0.43	0.09	....	30.3	0.4	41.9	5.3	9.6
Dump sample	0.49	....	....	....	....	....	...	...

Converters are lined with magnetite, which is built up as required, on top of the remainder of the original magnesite brick lining. The initial charge of the Peirce-Smith converters is 50 tons of matte. Additions are made consisting of seven to eight ladles of matte (ladles hold 15 tons of matte). The flux used in converting has the following composition: copper, 4.2 per cent; silica, 57.1; iron, 4.6; alumina, 9.1; lime, 0.3, and sulphur 1.6 per cent. The initial charge is about 3 tons and additions are made for each ladle of matte. All flux is introduced by the Garr gun. Charges composed of hood cleanings, anode slag, flue dust, and scrap copper, weighing about 5 tons each, are introduced at various times as the blow proceeds. The number of blows totals from seven to eight, each requiring about one hour. The total time from charging to finishing blister copper is about ten hours. The average weight of blister copper produced per charge is about 60 tons and the average weight of slag formed per charge about 90 tons. The blister copper is transferred to the holding furnace (oil fired) and is refined and poled before casting into anodes. The holding-furnace slag is returned to the converters and the converter slag is poured into the reverberatories close to the firing end.

The average analysis of converter slag is: Copper, 2.98 per cent; silica, 21; ferrous oxide, 63.1, and sulphur, 1.9 per cent. The average analysis of the anodes produced is: Copper, 99.61 per cent; lead, 0.064; nickel, 0.041; arsenic, 0.006; antimony, 0.014; selenium, 0.03 per cent; gold, 0.24 oz., and silver, 31.6 oz. per ton.

Total dust recovery from all of the flues and chambers is 11 tons per day, of which 24 per cent is from the reverberatories, 32 per cent from the roasters, and 44 per cent from the converters. There is no Cottrell plant and the low dust recovery indicates a considerable loss through chimneys. The total dust recovery amounts to only 0.18 per cent of the total ore handled. The metal content of the dust is given in the accompanying table.

Analysis of Flue Dust

	Gold, Oz. per Ton	Silver, Oz. per Ton	Lead, per Cent	Copper, per Cent
Reverberatories	0.03	6.5	1.9	8.6
Roasters	0.03	5.9	0.3	10.5
Converters	0.06	18.7	3.6	50.3

Reverberatory and roaster flue dust is returned to the Wedge roasters by gathering cars, which discharge into a hopper serving an air lift, which conveys the dust to the third hearth of the roasters. The converter flue dust is returned to the converters and also to the briquetting plant. Plans are being made for the construction of a baghouse to be placed in the lead blast-furnace flue system.

An ingenious method of sampling effluent gases after passing the dust chambers and flues has been developed by the technical staff of the smelter. A continuous sample of the gas is drawn from an intake pipe in the stack, the blast furnace, roaster and converter stacks each being provided with intake pipes. A fixed proportion of the total 24-hour volume is drawn out by a fan-type suction blower used as an exhaust. The waste-gas sample is drawn through a woolen bag, 18 in. in diameter and 10 to 15 ft. in length, the solids remaining in the bag, from which they are removed every day. The filter bag is dried and weighed to constant weight before it is used and this is repeated after the sampling period, the difference in the weights being the weight of the sample. By the use of a factor, the total weight of solids passing the intake point is computed. The sample is assayed for gold, silver, and lead. By the use of a piezometer ring, a silk diaphragm in a chamber connected with the piezometer leads, and electrical contacts operated by the diaphragm, variations in the velocity of stack gases automatically compensate themselves. C. G. Hershey, electrical engineer, has worked out the details of the mechanism, originally invented by Ross MacMichael, since deceased.

Probably the most important criticism that can be applied to the plant as a whole is the amount of hand labor and hand appliances required in the delivery of a part of the ore to the lead blast furnaces. The use of bedding floors is almost inseparable with lead smelting and the design of these appurtenances has not kept pace with the development of mechanical handling in other kinds of smelting. However, this limitation has been compensated for by the handling of a large part of the lead blast-furnace ores from bins, thus restricting hand labor to a relatively small tonnage. Another feature is the absence of fume-saving devices in the lead smelter. This undoubtedly has led to a considerable annual fume loss. In both of the foregoing criticisms, it is necessary to consider that the supply of lead ores was erratic and exceedingly small at times—too small, no doubt, to justify the capital investment necessary for a baghouse and mechanical handling equipment. The development of Ahumada materially changed the situation, and improvements are now under consideration to reduce metallurgical losses to a minimum. These improvements will provide for the bag filtration of the gases from the blast furnace and Dwight-Lloyd sintering machine.

Kuno Doerr is general manager of the Southwestern department and is in charge of operations at the El Paso smelter; H. F. Easter is plant superintendent; R. S. Moore, chief engineer; Paul Stein and R. C. Stryker, assistant superintendents, and N. A. Furguson, business manager. Acknowledgment is made of the courtesy of Mr. Doerr and his staff for their generous assistance in gathering the material for this article. Opportunity is also taken here to commend these men upon the order and neatness maintained at this plant and the high efficiency that is apparent under the limitations of the situation that is inevitable in a custom plant.

Dielectric Mineral Separation

Possible Applications of a Process Developed on a Laboratory Scale in England

By Bernard W. Holman

Imperial College of Science and Technology, London

IN TWO PAPERS presented before the Institution of Mining and Metallurgy last year[1] dielectric mineral separation was explained, and in an editorial published in the April 4, 1924, issue of *Mining Journal-Press* this interesting method of applying electricity to the concentration of minerals was further commented on. As H. S. Hatfield has pointed out, the employment of electrostatic force for the separation of minerals has hitherto been confined to processes of the Huff type, in which use is made of the force exerted by an electrostatic field upon charged particles, whereas in the method under discussion, the particles are uncharged. It is physically analogous to magnetic separation, which depends upon the action of a magnetic field upon unmagnetized particles, the force acting upon a particle depending upon the magnetic permeability of the subtance. With dielectric separation, the force acting upon a particle depends upon the dielectric constant, or specific inductive capacity, of the particle.

This process of separating minerals according to their different dielectric constants depends upon the repelling of one mineral and the attracting of the other in a suitable liquid. The liquid must be one that has a dielectric constant intermediate between the constants of the minerals that it is desired to separate. A mixture of various proportions of kerosene and nitrobenzene has been found useful, and, as it is rather expensive, must be carefully conserved.

This process can naturally be applied in many different forms of apparatus, but its special interest is twofold. First, unlike any other process of mineral separation, it is positive in action, not differential. The ore mineral is attracted and the gangue is repelled; therefore it is applicable to the separation of even the finest slimes. Second, its action is independent of the specific gravity, magnetic properties, or flotability of the minerals dealt with.

The applications of the process which are of immediate interest are, therefore, in the following fields:

1. Improved recovery from slime.
2. The treatment of ore containing finely disseminated minerals. Vast tonnages of such ore are now lying idle or are being treated with heavy loss of content—for example, in Burma and in the Stollberg and Rammelsburg districts in Germany.
3. Ores containing an appreciable proportion of their content in a very fine state of division—for example, many tin ores, and the pitchblende ore of Joachimsthal.
4. Ores containing a very friable mineral likely to slime—for example, the silver-gold sulphide ores of Sumatra, and Falherz silver ores.
5. Ores containing minerals of low specific gravity—for example, scheelite, erythrite, phosphate, apatite, and lepidolite.
6. Many oxidized ores and certain special mixtures such as boracite and gypsum, and Gwythyen sand from Wales.
7. Ores containing valuable minerals, the gangues of which have practically the same specific gravity—for example, roscoelite and vanadinite sandstones and carnotite ores, the gadolinite ores of Sweden, the phenacite sands of Liberia, and the autunite deposits of Portugal.
8. Ores occurring where water is scarce—for example, descloizite and cassiterite in southwest Africa, and chalcopyrite in central Spain.
9. Special products in chemical technology.

The first application of this process to mineral separation is due to Dr. H. Stafford Hatfield, who applied it to tin ores and later on to vanadium-bearing sandstone, with both of which excellent results were obtained. A large amount of laboratory testing with different minerals and ores has been carried out by St. J. Shepherd and by myself, but no work has been done at any mine.

The need now is for systematic quantitative tests on those ores which are of immediate commercial importance. Owing to the expense associated with new processes in their early stages, ores of class 7 might best be treated first. In this way, also, the handling of small tonnages could be dealt with and the practical difficulties of working the process overcome.

Such a program should be carried out in consultation with those people directly interested in the benefication of the ores tested. Sufficient academic work has been accomplished to show the possibilities of the method, so the mine, not the laboratory, is the place for the further development of the process.

[1] "Dielectric Mineral Separation: Notes on Laboratory Work," by Bernard W. Holman, and "Dielectric Separation; a New Method for the Treatment of Ores," by H. S. Hatfield.

A Table for Determining Drop in Pressure in Airways

By Walter S. Weeks and John T. Rutherford
University of California, Berkeley, Calif.

When air flows in a duct, energy is required to overcome friction against the sides and to overcome friction wherever layers of air are moving past each other. The consumption of energy manifests itself in a decrease in pressure as the air moves along the duct. In order that air may flow, a difference in pressure must exist between the two ends of the duct. Fans and blowers do not push the air through the pipes; they generate pressure, and the air flows from the region of high pressure to the region of low pressure. In most cases the difference of pressure between the two ends of the duct is so small that the air in the duct may be assumed to be at constant density.

The law as to the pressure necessary to force a liquid or gas through a duct is stated in the old hydraulic formula for turbulent flow.

$$h_f = \frac{flv^2}{y^2 g}$$

h_f = Decrease in pressure in feet of head.
fl = Length of duct in feet.
v = Average velocity in feet per second.
y = Hydraulic radius (cross-sectional area divided by perimeter of duct).
g = Acceleration due to gravity.

From this is derived the formula generally used in ventilation work.

$$P = \frac{cdSV^2}{A}$$

P = Decrease in pressure in pounds per square foot.
d = Density of air in pounds per cubic foot.
S = Rubbing surface in square feet (perimeter × length).
V = Average velocity in feet per minute.
A = Cross-sectional area of duct in square feet.
c = Friction factor.

The value of c depends chiefly upon the character of the walls of the duct. It is affected to some extent by the density, the viscosity and velocity of the air and by the area of the duct. The character of the walls has the greatest influence and the variation with the other factors is usually neglected.

$c \times d$ is usually combined into the constant K. Its composition, however, must always be remembered and its value must be changed in direct proportion to the air density.

The calculation of the loss of pressure in an airway is a tedious process, and so to lighten the work the table was prepared. It was calculated with the formula

$$i = \frac{KSQ^2}{5.2A^3}$$

This is the fundamental formula with the following substitutions:

$P = 5.2i$ (i = inches of water)

$V = \frac{Q}{A}$ (Q = cubic feet of air per minute)

The table was computed for ducts 1,000 ft. long, carrying 1,000 cu.ft. of air per minute with an assumed friction factor of 0.00000001. The width of the trapezoidal sections is measured at the base or track level. Example: Required the pressure in inches of

Rectangular Openings

Height	4					5				
Width	4	5	6	7	8	5	6	7	8	9
Area	16.00	20.00	24.00	28.00	32.00	25.00	30.00	35.00	40.00	45.00
Perimeter	16.00	18.00	20.00	22.00	24.00	20.00	22.00	24.00	26.00	28.00
W. G. 1,000 cu.ft.	.007512	.004327	.002782	.001927	.001409	.002461	.001567	.001077	.0007812	.0005909

Height	6					7				
Width	6	7	8	9	10	7	8	9	10	11
Area	36.00	42.00	48.00	54.00	60.00	49.00	56.00	63.00	70.00	77.00
Perimeter	24.00	26.00	28.00	30.00	32.00	28.00	30.00	32.00	34.00	36.00
W. G. 1,000 cu.ft.	.0009892	.0006749	.0004869	.0003664	.0002849	.0004577	.0003285	.0002461	.0001906	.0001516

Height	8					9				
Width	8	9	10	11	12	9	10	11	12	13
Area	64.00	72.00	80.00	88.00	96.00	81.00	90.00	99.00	108.00	117.00
Perimeter	32.00	34.00	36.00	38.00	40.00	36.00	38.00	40.00	42.00	44.00
W. G. 1,000 cu.ft.	.0002347	.0001752	.0001352	.0001072	.00008694	.0001303	.0001002	.00007928	.00006412	.00005283

Height	10				
Width	10	11	12	13	14
Area	100.00	110.00	120.00	130.00	140.00
Perimeter	40.00	42.00	44.00	46.00	48.00
W. G. 1,000 cu.ft.	.00007692	.00006068	.00004897	.00004026	.00003364

Trapezoidal Openings

Slope of Sides 1 Horizontal to 6 Vertical

Height	4					5				
Width	4	5	6	7	8	5	6	7	8	9
Area	13.33	17.33	21.33	25.33	29.33	20.83	25.83	30.83	35.83	40.83
Perimeter	14.78	16.78	18.78	20.78	22.78	18.47	20.47	22.47	24.47	26.47
W. G. 1,000 cu.ft.	.011996	.006197	.003720	.002458	.001735	.003927	.002283	.001474	.001023	.0007476

Height	6						7					
Width	5	6	7	8	9	10	5	6	7	8	9	10	11
Area	24.00	30.00	36.00	42.00	48.00	54.00	26.84	33.84	40.84	47.84	54.84	61.84	68.84
Perimeter	20.17	22.17	24.17	26.17	28.17	30.17	21.86	23.86	25.86	27.86	29.86	31.86	33.86
W. G. 1,000 cu.ft.	.002805	.001578	.0009961	.0006792	.0004898	.0003684	.002175	.001184	.0007302	.0004894	.0003482	.0002591	.0001996

Height	8					9				
Width	8	9	10	11	12	9	10	11	12	13
Area	53.34	61.34	69.34	77.34	85.34	67.50	76.50	85.50	94.50	103.50
Perimeter	29.55	31.55	33.55	35.55	37.55	33.25	35.25	37.25	39.25	41.25
W. G. 1,000 cu.ft.	.0003746	.0002630	.0001936	.0001478	.0001162	.0002079	.0001514	.0001146	.00008944	.00007154

Height	10				
Width	10	11	12	13	14
Area	83.33	93.33	103.33	113.33	123.33
Perimeter	36.94	38.94	40.94	42.94	44.94
W. G. 1,000 cu.ft.	.0001227	.00009211	.00007136	.00005672	.00004604

Circular Openings

Diameter	4	5	6	7	8	9	10
Area	12.57	19.63	28.27	38.48	50.27	63.62	78.54
Perimeter	12.57	15.71	18.85	21.99	25.13	28.27	31.42
W. G. 1,000 cu.ft.	.01217	.003994	.001601	.0007422	.0003804	.0002112	.0001248

water to drive 20,000 cu.ft. air per minute through a 6x8-ft. rectangular opening having a friction factor of 0.000000007 and a length of 10,000 ft.

Referring to the table for rectangular openings under height of 6 ft. and width of 8 ft., the pressure under assumed conditions is found to be 0.0004869.

Pressure varies directly as the length, so the correction for length is $\frac{10,000}{1,000} = 10$.

Pressure varies directly as the square of the quantity, so the correction for quantity is $\left(\frac{20,000}{1,000}\right)^2 = 400$.

Pressure varies directly as the friction factor, so the correction for friction factor is $\frac{0.000000007}{0.00000001} = 0.7$.

The required pressure is then:

$10 \times 400 \times 0.7 \times 0.0004869 = 1.36$ inches.

Rule: For determining loss of pressure in a duct, multiply the water-gage given in the table for the proper dimensions, by the length divided by 1,000, the square of the quantity-divided-by-1,000, and by the friction factor with the decimal place moved eight places to the right.

Blowing Sand Filling Into Champion Stopes

By M. W. Youngs

Mill tailing or "stamp sand" from the Champion mill is used for filling in place of waste rock in worked-out stopes in the Champion mine of the Copper Range Co., in the Michigan copper district. The method of introducing the sand is ingenious. The cars that transport rock to the mill are used to haul sand back to the mine, where it is dumped into a raise paralleling No. 4 shaft, which connects with all working levels. The sand is drawn from chutes in bottom-dump cars and hauled by motor to raises communicating with stopes below. The raises serve as storage to feed sand-blowing tanks operated by compressed air and installed directly underneath the raise. The bottom of the raise is stopped by a sollar, to which is attached a 10-in. pipe and gate for drawing sand from the raise. The equipment and operation are described as follows:

The tank is cylindrical and has a capacity of about 1½ tons. It is coned at both ends. The top cone contains a counterbalanced gate that swings down away from the flow of the sand when the tank is being charged. This gate, or valve, seats against the under side of the head by means of a rubber gasket, thus making an air-tight compartment when closed. The bottom cone of the tank connects to a 6-in. tee placed horizontally and connected at one end through a reducer to a 4-in. distributing pipe which rests on the fill. The other end of the tee has a reducing flange, to the inside of which is secured a short 1-in. pipe nipple, which is reduced at the end to form a nozzle. A 1¼-in. pipe connects the outside of the reducing flange to the top of the tank, and this connecting line is in turn connected to the main air line, valves being suitably placed to permit regulation of air to either the top or the bottom of the tank as required.

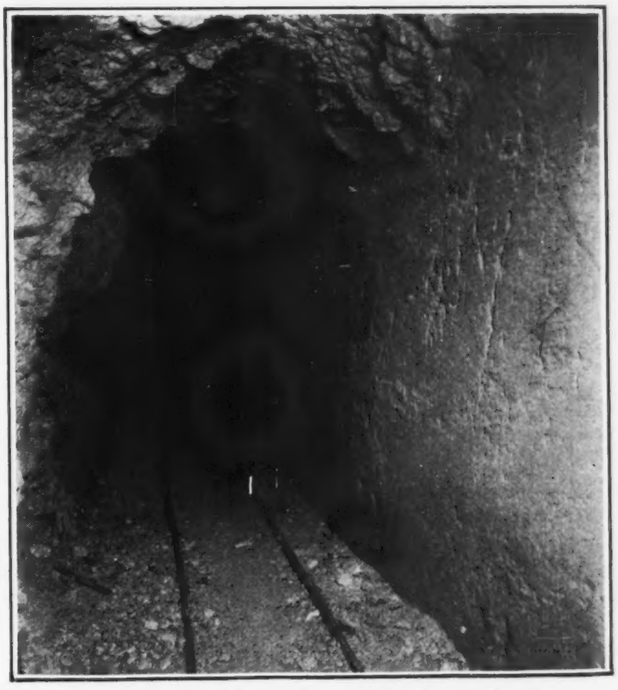
Extra heavy black pipe, cut to 6-ft. lengths and joined by Dressler couplings, are used for the distributing line. The use of these couplings permits deflecting the pipe so as to go around obstructions. Threading pipes would result in getting only about one-half of the wear, for when the pipe is half worn, the root of the threads would be exposed and the thread cut off, making it necessary to discard the pipe. Instead, the pipe can be used until worn through. Frequent turning of the pipes distributes the wear. They last from three to six months.

Operation consists of drawing sand from the raise into the tank; when the tank is almost full, the upper gate is first closed, and then the counterbalanced valve. Compressed air is applied, which seats and holds the balanced valve, and the pressure in the tank feeds the sand through the distributing pipe. When the tank is nearly empty, the air is shut off, permitting that which is confined in the tank to expand and expel the remainder of the charge. The upper valves are again opened, the tank filled, and the operation repeated.

By shifting the line, the sand filling is carried the width of the stope. As the pile of fill advances, the line is extended. The force of the sand leaving the pipe is such as to carry it about 20 ft. beyond the pipe. Sand is transmitted up to 250 ft. without difficulty in this manner. The air pressure used is from 70 to 80 lb. To load and discharge a tank of sand (1½ tons) requires from two to three minutes, depending on the length of the line, fineness of sand, and moisture contained. The shorter the line, or the coarser the sand up to quarter-mesh and the drier it is, the greater the speed of operation. One man is required to operate the tank and extend the line. From 500 to 1,500 cu.ft. of free air is used per ton of sand moved.

An Unusually Well-Defined Wall

In driving the new Star Light tunnel on the Mayflower group of claims at Pioneer, Nev., the miners have broken to the wall here illustrated for a distance of about 800 ft. Other tunnels and shafts along the outcrop have revealed the wall with the same remarkable smoothness. It furnishes an excellent drawing board for the miners who are artistically inclined, as the photo will show.



In the Star Light tunnel at Mayflower, Nev.

Mining Camps of North America

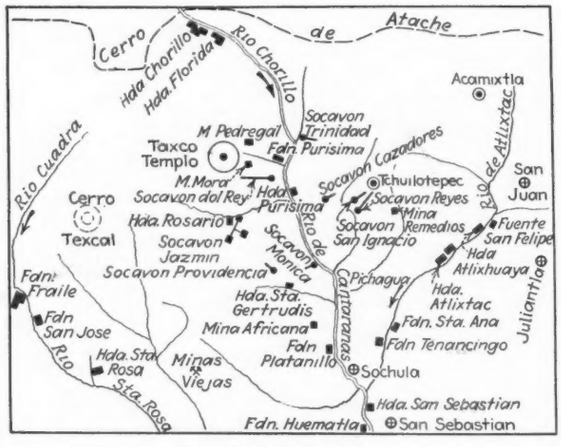
Taxco, in Guerrero, Mexico

Preferential Flotation of Complex Ores May Revive Old District

By Robert Bruce Brinsmade

SITUATED in northern Guerrero at an altitude of 6,000 ft., the ancient city of Taxco has a climate of perpetual spring. The oak forests that once clothed the region have long since been razed for fuel, so that one now sees in the vicinity well-rounded hills of limestone and slate covered with grass and maize. This landscape covers all sides except the north, where the high cliffs of the Huisteco range of intensive rock extends to the northwest and shelters also the mining districts of Tetipac and Zacualpan. Protected from the northern winds by this mountain barrier, the district produces oranges, limes, zapotes, and other semi-tropical fruits as well as those of the temperate zone. The average yearly temperature is 72 deg. F., with maximum of 80 deg. and minimum of 55 deg., while the rainfall is 8 to 12 in. annually and falls mostly in the rainy season from May to November.

The district attracted the attention of the Spaniards soon after the Conquest from the fact that "gold" bricks had been sent from "Tlacho" to Moctezuma. Yet an investigation showed that silver was the abundant metal, and in 1529 this resulted in the founding of the present city of Taxco, in the midst of the newly discovered veins, and three leagues to the north of the original Indian village of Tlacho, which is now called Taxco Viejo. Like all old mining towns, Taxco has varied in population according to the activity of its mines; at present it has sunk to 2,500 people, the smallest number of recent times. As a consequence the houses, well built in terraces of stuccoed rubble masonry, are only partly occupied. The streets are narrow and generally so steep that it is only their cobblestone



The Taxco district in northern Guerrero

pavement that renders them passable for animals in the wet season for their highest and lowest points are, respectively, 180 and 350 ft., vertically, above and below the central square. Nevertheless each house has its water supply, which is brought in an ancient stone aqueduct, fed by nearby springs and run around the streets in threaded iron piping. There is also a local electric lighting plant and national telegraph connections. The nearest railway station is Naranjo, on the Cuernavaca-Balsas line, which is about 15 miles distant and 3,000 ft. lower in altitude. Hitherto the wagon road has been poor. Since 1920, however, the automobile highway from Mexico City to the picturesque port of Acapulco has been under construction and when the line from Puento de Ixtla to Iguala, passing Taxco, is completed, the transport conditions will be vastly improved.

Jose de la Borda

The mining history of Taxco has been most romantic. There yet exists the great adit, Socavon del Rey, begun by Herman Cortes, of a size to pass easily a mounted knight, and subsequently extended to its present length of 2,150 ft. The silver output of the first two centuries after the Conquest was not large, as the Spanish *encomenderos* of the region preferred ranching to mining. It was not until the advent in Taxco of that famous darling of fortune, Jose de la Borda, that the camp leaped into world renown.

The orphan of a French officer in the army of Louis XIV, Jose emigrated in 1716 from France to take refuge with his uncle, Francisco de la Borda, a miner of Taxco. Succeeding his relative in the operation of his mines, Jose discovered in 1747 the great bonanza of the San Ignacio mine at Tehuilotepec, a league east of Taxco city. This bonanza lasted nine years and authorities differ as to its yield, but, if we accept the most probable figure of Jose's profit as 2,000,000 pesos, the gross yield in ounces of silver must have been considerably more.

The Famous Taxco Cathedral

As an example of the direct crystallization of the mining profits into a wonderful local work of art, the Taxco cathedral, built by Jose de la Borda, must always be of interest to miners. For its construction the best artists were imported from Spain, Italy and France for a stay of ten years. The stone used was a pink rhyolite brought from the quarry of Huisteco, 5 miles distant, and dressed smoothly for ashlar masonry; originally the finish was stone both outside and inside the structure, but at present the interior is marred by a covering of painted plaster. The towers are 145 ft. to top of crosses and the main arch is 60 ft. above the floor. The building itself cost only 471,772 pesos, or less than a third of the total, while the interior shrines, pulpits, altars, and pictures accounted for 590,000 and the sacred vessels and ornaments for the balance of 600,000 in the gross cost of 1,661,772 pesos. Among the treasures of the sacristy are the best pictures of Miguel Calvera, the noted Mexican artist of that epoch. The greatest mineral wonder was the chalice, which was a cup of pure gold weighing 724 oz. and 1⅛ yd. high. In its front were set 5,872 diamonds and in its back were 2,635 emeralds, 544 rubies, 106 amethysts and 28 sapphires.

It was this precious chalice, returned to him in pity by the bishop, that later rescued De la Borda from bankruptcy, when he had spent his remaining profits in a fruitless search in Taxco for more bonanzas. After selling the chalice to the cathedral of Mexico City for 100,000 pesos, he went in 1763 to Zacatecas and at first wasted much of this sum in an attempt to reopen the Quebradillas shaft. Later, however, he struck a new bonanza in the adjoining Esperanza mine and finally died worth 3,000,000 Tornese pounds. And this in spite of expending a large sum in futile explorations at Tlalpajuahua, in Michoacan, where he also built a cathedral, and a further sum in the construction of the De la Borda garden at Cuernavaca in Morelos.

While the rate of production of Taxco has never since equaled that of the De la Borda epoch, the gross output may have exceeded 60,000,000 oz. of silver. A famous successor of De la Borda was the Viscount de Anza, who tapped the San Ignacio vein by a lower adit, Los Reyes, 2,600 ft. in length, and extended the old Socavon del Rey to its present face. De Anza is mentioned by Von Humboldt, in his chronicles of his Mexican journey at the beginning of the nineteenth century, as "a bold explorer who was disappointed at finding that the Taxco veins in depth were poor in red silver and abounding only in galena, pyrites and yellow blende."

Four Types of Ore

Von Humboldt also remarks: "The Taxco veins are very numerous and, except those of Cerro Campana in Tehuilotepec, strike northwest to southeast and dip 7 to 9 deg. from the vertical. The best values are above in the limestone and the veins get poorer in silver as they cut the slate in depth. The veins of the richest or Tehuilotepec region, are 2 to 3 m. (6.5 to 9.8 ft.) thick of quartz and are separated from the walls by clay selvage, while their oreshoots occur at the intersection of a main vein by a branch. The metal is seldom uniformly disseminated in the quartz, but concentrated in a paystreak following a veinwall. The silver values are extremely irregular; four classes of ore may be identified:

"(1) Native and horn silver finely disseminated in yellow, brown and red oxides of iron. This ore resembles the *pacos* of Cerro de Pasco in Peru and, like the latter, contains, as accessory minerals, specular hematite, magnetite, malachite, and galena. The coppery ores indicate the best grade, which seldom exceeds 80 oz. per ton. (2) Native silver with a little galena occurring with calespar and gypsum containing air bubbles. This class was found in the Trinidad vein at a depth of 100 m. (328.1 ft.) between limestone walls. (3) Spherical balls of 10 cm. (3.937 in.) or more in diameter containing horn, native and red silver along with yellow and brown blende, pyrites and gypsum, alternating in bands with milky quartz. These balls occurred in the San Ignacio, Dolores and Perdon veins, between depths of 15 and 60 m. (49.215 and 256.86 ft.) in a gangue of calespar, and made the richest class of all. (4) Silver-bearing galena, which is the richer when fine grained, and has as accessories yellow blende, calespar, and a little pyrite. This class occurs typically in the Marquesa and Socavon del Rey mines."

After 1810, like all Mexican camps, Taxco fell into decline due to the departure of the Spanish operators and the increase of brigandage during the ten-year War of Independence from the arming of the Indians, who had never been allowed muskets during the colonial period. As late as 1883, when the government engineer La Guerrenne visited Taxco, there was little activity and few shafts over 325 ft. deep. Even with the inauguration of the railway age, a little later, and the installation of steam hoists and pumps, there was slight increase in the output up to the fall of Diaz.

The Taxco district may be included, as in the accompanying map, in a rectangle extending about six miles from east to west and about four miles from north to south. The important mines may be bounded by a yet smaller rectangle extending two miles north from the Africana shaft and four miles west from the village of Juliantla. The center of mineralization lies near to and southwest of the village of Tehuilotepec in a vein-system cutting a series of limestones, limey and clay slates, and mica schists which slope south from the rhyolite cliffs of the Cerro Atache, a branch of the Huisteco range. The main veins strike 6 to 45 deg. west of north and dip sub-vertically, while a secondary system strikes northeasterly. There are also occasional contact beds, as the replacement lenses between slate and limestone found in the San Miguel and Trinidad mines; also intercalated lenses found in the marls of the Ojo de Agua and San Jose mines of the Cerro Texcal.

The cathedral at Taxco

Built in the eighteenth century at a cost of 1,661,772 pesos. The stone is pink rhyolite.

The fissure veins have yielded most of the ore and are filled chiefly with quartz and accessory calcite, though on the west side the latter sometimes occupies the whole fissure except for frequent pieces broken from the vein-walls. The oreshoots or bonanzas are usually found at the intersection of two veins or at the sprouting of a branch from the main vein, and outside of these the vein is apt to be barren of pay-ore. In some shoots the metals are in paystreaks, in others they are distributed throughout the gangue. In some places the

veins split up and show only a network of quartz veinlets in the wall rock. Near the surface the oreshoots contain iron oxides with native and horn silver, argentite, stephanite, pyrargyrite, and proustite along with abundant sphalerite and a little cerussite and galena, but in depth the silver decreases and leaves only the sulphides of base metals, which up to date seldom have been profitable to mine alone.

Little Deep Mining in Early Days

The rich silver ores long ago described by Von Humboldt and extracted in the bonanzas of the big veins, like the Espiritu Santo, the Vermeja, the Marquesa and the San Ignacio, were partly the product of secondary enrichment, for in depth the old miners always reached lean ores and stopped digging, as can be noticed from the surface, where there are outcrop stopes from 1,000 to 1,600 ft. long. This impoverishment occurs not only when the vein-walls change in depth from slate to mica schist, as can be seen in riding south in Cantaranas gulch from the Pedregal mine, but also when the veins get too far away from the east-west intrusive range of the Cerro Atache; for, though the Providencia and Monica mines have slate walls and are shallow, they show only base metal sulphides lean in silver.

Some quicksilver was taken from the upper workings of the Pedregal mine in early days but, as indicated by the zonal theory of metallic deposition, it was only of a superficial character.

More Modern Operations

If we review the major operations in Taxco of the last twenty years, we have first those of the Taxco Mines, Ltd., a London company which bought the Rosario property before the revolution and spent $125,000 in exploration of the three veins tapped by the Jazmin adit, of 600 ft. length, which is connected with the Analco and Xohocotitlan shafts; the latter is 300 ft. deep and both shafts have small steam hoists. These veins are respectively 35, 45 and 120 in. thick and the payshoots are said to yield ore averaging 30 oz. silver per ton. A 3-in. streak in the widest vein averaged 100 oz.

During the period 1913 to 1920, Taxco, along with the remainder of northern Guerrero, was ravaged by the Zapatista bandits, and mining was hardly possible. Nevertheless in September of 1919, a company called Explotadora de Minas de Mexico, this company owning most of the great Bermeja, Espiritu Santo and Marquesa veins, prior to the shutdown in January of 1921 had expended $270,000. Part of this was spent in reopening the Pedregal and Bermeja mines and the rest in building an aqueduct and a cartroad to a new millsite that had been acquired at Pichagua, north of the Platanillo plant in Cantaranas gulch. The three veins mentioned are 35 to 50 in. thick on an average, though some of the old stopes are 20 ft. thick. Besides the adit, Socavon del Rey, which cuts these three and five minor veins, there is the San Luis adit, which is 650 ft. long and cuts the Marquesa and Bermeja veins. The Pedregal shaft is 780 ft., vertical, the deepest of the district, and is equipped with a duplex steam hoist of 20 hp. and a 30-hp. boiler.

The Restauradora company has the Atlixhuaya plant on Atlixtac creek and owns the Africana, Esmeralda and other mines. The company spent $400,000 on its mines and plant before the revolution and only resumed work in 1922 after a long shutdown. The plant lies at an elevation of 4,800 ft. and includes a 10-ton concentrator and a smelter. The former has a Dodge 7x9-in. breaker, two 3½-ft. Huntington mills, two Wilfley tables and one Deister table. The smelter has a 30-ton, Allis-Chalmers, water-jacketed, lead blast-furnace with Roots blower turned by a 50-hp. Corliss engine supplied by a 60-hp. boiler. The sorted sulphide mine ore had 700 grams silver and 14 per cent zinc and was enriched up to 9 per cent lead with some purchased galena. After roasting in heaps, 400 tons of this ore was mixed with local limestone and iron ore (found in a chimney of 25 ft. diameter near Platamillo) and smelted at an operating cost of $22 per ton. A new manager then tried smelting the raw ore and froze the furnace several times as a result; later he tried milling it and made some lean marketable concentrate. By this time the working capital of $85,000 had been exhausted and the inevitable shutdown ensued.

The last important expenditure of $250,000 has been made in the last two years by a French group in exploring under option the El Fenix company's property near Juliantla. Though there are a number of veins, the grade of ore encountered has been disappointing and the property probably will be soon given up.

Before describing the three enterprises now active, the Atlixtac, the San Juan, and the Santa Rosa, I shall sketch briefly the condition of the various other plants shown on the map, all of which are now idle or abandoned but still visible, as distinguished from the numerous previous plants whose very existence is a matter of ancient history.

First, there are, or were, seven mills, of which the San Sebastian, the Sta. Gertrudis, the Florida, and the San Juan Bautista (southeast of Juliantla and beyond map) are in ruins. The fifth is the Rosario mill of the Taxco Mines Co., Ltd., which is located on a sloping site and has a stone masonry building with a roof of corrugated iron. It was originally equipped with a Dodge breaker, two geared Cornish rolls, and two 3½-ft. Huntington mills, which delivered the pulverized ore to an outside concrete floor, where it was treated by the usual patio process. Fifteen years ago the ore got too refractory for the patio and four 4-ft. and one 6-ft. Frue vanners were installed to concentrate it, but this scheme was a commercial failure and the plant has been idle ever since.

The sixth mill is the Purisima of the Explotadora company, which had a Dodge breaker, a Huntington mill, some shaking tables and a five-stamp battery with a 35-hp. boiler and a waterwheel for power. This plant is now partly dismantled, as the company plans to build a new flotation mill at Pichagua to replace it as aforementioned. The last mill is that of the Chorilla smelter, with which it will be described later.

Second, there are four Castilian furnace plants. Of these the Tenancingo and the Platamillo are in ruins. The latter owed its location to a cataclysm which occurred in 1802, when the large spring at San Felipe, 2½ miles to the northeast, suddenly disappeared and burst forth instead at Platamillo. The Purisima, the third smelter, has been in operation most of the time for half a century and was last run in 1923. It contains two "chacuacos" or stone blast furnaces; these, though of hearth area of only 3 sq.ft. each, have a 3-ton daily capacity with docile ore and run. It is owned by Pedro Flores and was last used to smelt ores from the neighboring Mora-Milagro mines which were a mixture of lead, iron and zinc oxides and sulphides averaging 30 oz.

silver. As flux a docile iron oxide ore with 5 per cent lead was brought from Cerro Texcal, and for fuel charcoal was used. The bullion contained 200 to 300 oz. silver and 30 grains of gold, and this was refined in a German cupell to doré bars, 0.925 fine. Enough litharge was returned to the blast furnace to bring the charge up to 20 per cent lead and the slag ran 30 per cent silica, 20 per cent lime and 40 per cent iron. The little matte and speiss produced were resmelted. The power came from a 10-hp. charcoal-gas engine of Tangye make, which drove a small Allis-Chalmers dynamo. Part of this current turned a motor driving a 20-in. Smith fan to supply air to the cupell furnaces, and the rest furnished electric light for Taxco city. Fifteen men were required in the plant in twenty-four hours.

Stone Blast Furnaces

The last Castilian plant is the San Jose, which has two stone blast furnaces, about 5 ft. square inside the tuyères, each with a daily capacity of 20 tons of charge with docile ore. The Tecapulco Mining Co. owns this smelter, also the San Antonio mine in the Cerro Texcal, which supplied lead ore until it caved in two years ago, owing to lack of timbering, and caused the shutdown of the furnaces.

The last class of plant is the water-jacket lead smelter, of which there are five. The first is the Atlixhuaya plant and the second is the Santa Ana, used by the defunct Aztecas Mineral Co., owner of the Providencia group of lead-zinc mines, to smelt the concentrate from its Santa Gertrudis mill in Mango gulch. Both mill and smelter were destroyed by the Zapatistas. The third smelter is the Huematla, owned by the El Fenix company, which never had anything but a trial run, as it was found, when too late, that the mines had no ore suitable for it. It has a 48x72-in. furnace with eight 4-in. tuyères.

The fourth smelter is the Fraile, of the Mexican Smelting & Refining Co., which owns mines in the adjoining Cerro Texcal, including the Florencia, San Isidro, Ojo de Agua, Santiago, and Esperanza, all developed by shafts or adits, of which the longest is 400 ft. The smelter contains a 50-ton blast furnace and a German cupell. Air is supplied by a Connellsville 15-hp. blower with a Root blower as relay. Power comes from a Westinghouse charcoal-gas engine whenever the water supply is inadequate to operate the turbine. Though now idle, this plant was run successfully before the revolution.

For this oxidized charge containing 10 per cent lead, the fuel was 16 per cent, equal parts of coke and charcoal. The slag ran 34 per cent silica, 22 per cent lime and 43 per cent iron. The work lead had 125 to 145 oz. silver per ton and was cupelled for doré bullion and a litharge containing up to 6½ oz. of silver per ton.

The last smelter is the Chorillo, with which is a small mill. The mill has a Dodge breaker, a stamp battery of five 820-lb. stamps, two Johnston vanners, and two rectangular canvas side-shaking tables. The smelter has two Castilian blast furnaces, a German cupell and a blower. Power is furnished in the wet season by a wooden water wheel with 550-in. head and in the dry season by a small steam engine.

Of the three active enterprises the Atlixtac is by far the largest. This company owns 60 acres of ground developed by the Trinidad, Mexico, Cuauhtemoc, and San Jose adits and by the San Jose, Astillero, Perdon, San Pablo, and Remedios shafts. The last is 325 ft. deep and has a 15-hp. steam hoist and a 15-hp. compressor for rock drilling. Shortly before the revolution, there was found in the Trinidad vein, by following a fault at 260 ft. depth, an old-fashioned bonanza of 480 oz. silver ore, which gave smelter returns of $600,000.

At this period, too, was erected a modern cyanide mill in Atlixtac gulch at an elevation of 4,800 ft. The equipment included two small Dodge breakers, four five-stamp batteries, two 14½x5-ft. tube mills, one 8x2½-ft. Hardinge mill, eight Deister tables, two Dorr settlers, four Pachuca tanks, seven zinc boxes, one twenty-five leaf vacuum filter and two tailing elevators. For power were two charcoal gas engines, from Tosi Legnano of Italy, one of 100 and the other of 80 hp.; also one 15-hp. Crossley gas engine, two Ingersoll-Rand air compressors, Class N.E.-1, and a 15-hp. G.E. dynamo. Unfortunately a trial of eight months proved the mill a practical failure. The company's milling ore consisted of zinc blende, galena and the sulpharsenides and antimonides of silver, so finely disseminated in quartz and slate that the concentrating tables failed to remove more than half of these sulphides, which passed into the tailing and made the cyaniding extraction poor and the filtering difficult.

The Chorillo smelter at Taxco

However, with the increased demand from Europe for Mexican zinc ores, the Atlixtac property again became interesting and it was taken over last April under a five-year lease by the International Ore Co. of Saltillo, with an option to purchase at a price said to be $1,200,000. The new owner is reopening the mines and making over the cyanide mill into a flotation plant of 60-ton daily capacity along the following scheme: The present equipment will be mostly utilized and supplemented by a new Marcy roller mill, an 80-hp. Diesel engine, flotation machines of Fagergren type, American disk filters, and mechanical driers for the concentrates. These will be of two classes of concentrate made by differential flotation: a lead-silver concentrate for sale in northern Mexico, and zinc blende for export.

The San Juan is a 10-ton flotation plant just completed by two Mexican army officers to treat the ore from the Dos and Trancas mines, which are opened by an old 2,300-ft. adit. It is equipped with a breaker, a Krupp ball mill, and flotation machines, with a 25-hp. engine and boiler. It will produce a silver-lead and a zinc concentrate as in the Atlixtac mill.

A new company, El Manto y Anexas, controls the Tres Senores and Pastora mines at Cerro Texcal and the Carmon and Jesus at Mines Viejas. The last mine is peculiar in having four adjoining parallel veins of calcite at the outcrop, each 240 in. wide, which dip 70 deg. between outside walls 20 ft. apart and are parted by the slate country rock. They contain sulphides of zinc, lead and silver. This company has just completed a new 20-ton flotation plant on the site of an old mill at Santa Rosa. There is a breaker, a Marcy No. 43 ball mill, working in closed circuit with a Dorr rake classifier, two Plato tables and two K-K flotation machines: an 8-ft. rougher, and a 6-ft. cleaner. The required 35 hp. will come from a 6-ft. Pelton wheel operating under a 90-ft. head of water, brought in by a stone aqueduct of 3,600 ft. length. Here, too, a marketable silver-lead and a zinc concentrate will be made from the company's ores. But instead of a continuous flotation flow, as at the Atlixtac mill, it is planned to economize in agitators by running one agitator charge till the concentrate is clean, storing the mill discharge meantime in an intermediate tank.

Future Appears Bright, as Metallurgical Difficulties Are Overcome

The immediate future of Taxco as a producer does not depend alone on the success of the new differential flotation process, as there is a considerable quantity of brown zinc blende in the Monica and adjoining veins which runs over 40 per cent zinc as extracted, and can be raised to a high-grade product by gravity concentration. The conquest of the metallurgical difficulties which have prevented the revival of Taxco in recent years is thus in sight. In spite of the fact that over a million pesos has been spent in exploration and experiments since 1900 without beneficial results, the camp now appears to have a bright future.

The natural obstacle to ore discovery, that oreshoots at Taxco occupy only a small part of the extension of the numerous veins of quartz or calcite, doubtless will be much lessened in the future by a careful general mapping of both the outcrops and the mine openings. Nevertheless even at present there is much milling silver ore known to exist at the bottom of the old bonanza slopes without regarding the cleaner zinc sulphides. Moreover, there is a possibility of a copper output, as the bedded lense, Manto Cobriza, in the Remedios mine, contains much chalcopyrite along with pyrite and galena, while a little farther east in the Cobre vein of the Tonazitla claim is an oreshoot of chalcopyrite and pyrite in quartz running 10 per cent copper.

A new obstacle to profitable mining at Taxco is the increase of wages, as miners now get $1.50 and laborers get $1 per day, as compared with half these rates in 1910. This increase is necessary to balance the higher cost of living partly due to the havoc wrought in native food-producing capacity by the revolution, and partly to the higher cost of government and of railway transportation. The former obstacle of inaccessibility bids fair to be overcome this year in Taxco by the arrival of the national automobile highway connecting direct with the railway at Naranjo, while the last obstacle, lack of cheap power, is no longer serious. Large plants can easily bring in electric current from the nearby hydraulic plant at Zacualpan and small ones can use the economical charcoal-gas engine, which is now more dependable than ever before.

Magnitude of the Hollinger Mine

Speaking to the shareholders of the Hollinger Consolidated Gold Mines, of Ontario, Noah A. Timmins, the president, recently emphasized the magnitude of the enterprise by saying:

"As to the mine the reports speak for themselves; 94.5 per cent of the possible running time gave a record of 1,659,475 tons of ore milled, of higher grade and at lower working costs.

"When one stops to analyze those tonnage figures a little closer, Hollinger's magnitude as an industrial proposition will be better understood. Let us try, if we can, to visualize that huge tonnage of ore—and ore is nothing more or less than good hard rock—in terms of railway cars and trains. It is well known that the capacity of an ordinary open railroad car or 'gondola' ranges between 40 and 60 tons. Let us use 50 tons per car as a basis for our computation.

"With 50 tons per car as a starting point, and 1,659,475 tons as the total to be loaded into these cars, we find that it would take 33,100 such cars to transport that load. Divide those cars still further into trainloads of fifty cars per train and we find that 664 trainloads, fifty cars to a train and 50 tons to a car, would be needed to move that immense tonnage.

"Or we can approach the problem from another angle by assuming that the rock removed during 1924 from Hollinger's underground workings be used for road ballast. Should such use be made of that material enough would have been available in 1924 to cover a road 18 ft. wide, 226 miles long, 1 ft. deep. And what a contribution to the good roads system of any province such a highway would be.

"Such computations as these are used to assist in conveying to shareholders some conception of Hollinger's industrial magnitude."

Largest Output of Fuller's Earth During 1924

The largest output of fuller's earth on record is that for 1924, as reported by the U. S. Geological Survey, working in co-operation with the state Geological Surveys in Alabama, Florida, Georgia, and Illinois. Thirteen operators in six states reported that 177,994 short tons of fuller's earth was sold in 1924, valued at $2,632,342, or $14.79 a ton. This output is 19 per cent greater than that of 1923, but it is more than four times that of 1914. The value of the output for 1924 was also the largest ever recorded. It was 17 per cent greater than that of 1923 and 5 per cent greater than that of 1920, the previous year having the record of greatest value. It was more than six times as large as that of 1914. Since 1920 there has been a steady decline in the average price per ton, the price in 1924 being nearly $5 lower than that in 1920, the year of highest average.

The South continues to produce the larger part of the output. Georgia was the leading state in output and value, displacing Florida, which has occupied that position since the beginning of the industry. Florida was second and Texas was third in output and value. These three states reported 93 per cent of the output and value in 1924. The producing states, named in the order of their output, were Georgia, Florida, Texas, Illinois, Massachusetts, and Alabama.

Useful Operating Ideas

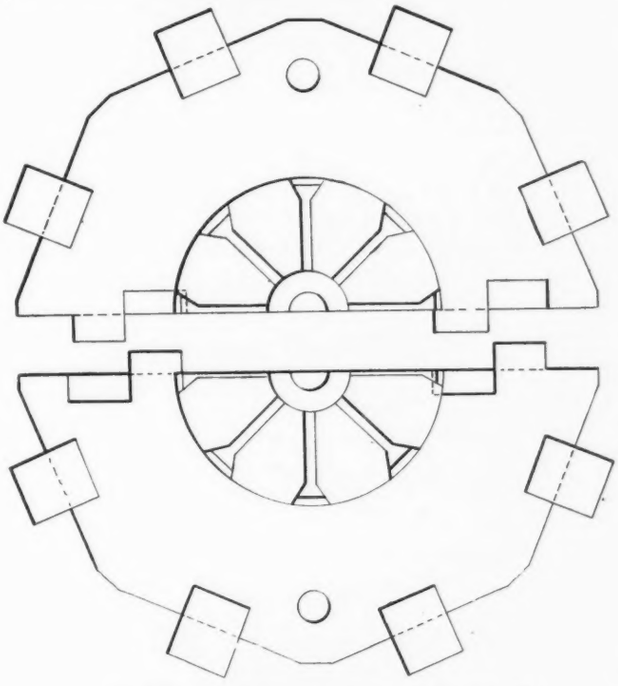
Center Discharge Liner

By Frank Cooper

Mill Superintendent, Minas del Tajo, Rosario, Sinaloa, Mexico

The construction of a combined center discharge liner and cone is shown in the accompanying illustration. It is used in a 64½ Marcy mill. The discharge liners usually furnished by supply houses are in two pieces and the center discharge cone is in one piece. Considerable trouble was experienced in operating the Marcy mills by the center discharge cone working loose and allowing sand to wear the points of the ribs upon which the cone seated. In changing grates it was usually necessary to drill and tap new holes for the stud bolts holding the cone in place.

With the new design, half of the center discharge cone is cast integral with half of the center discharge

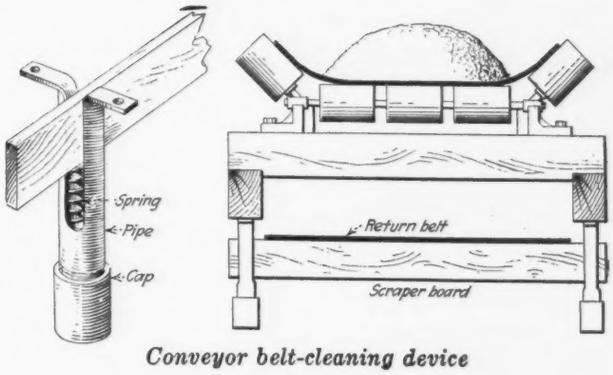


Center discharge liner for Marcy mill

liner, thus reducing the number of pieces from three to two. The new liner has resulted in reducing the time required for relining the mill and has given no trouble from the wearing of the ribs.

Cleaning Conveyor Belts

With soft, clayey ores, more or less fine material accumulates on the surface of belt conveyors and although a part of this accumulation is discharged with the ore, part remains on the belt and is distributed along the runways. At El Paso smelter, scraper boards are placed under the return belt near the discharge end for the purpose of cleaning the belt as much as possible. These



Conveyor belt-cleaning device

consist of a ½-in. board, 4 in. in width, held in two supports and pressed against the return belt by springs. The weight of the belt causes it to scrape over the board, clearing itself. The accompanying illustration shows in detail the arrangement.

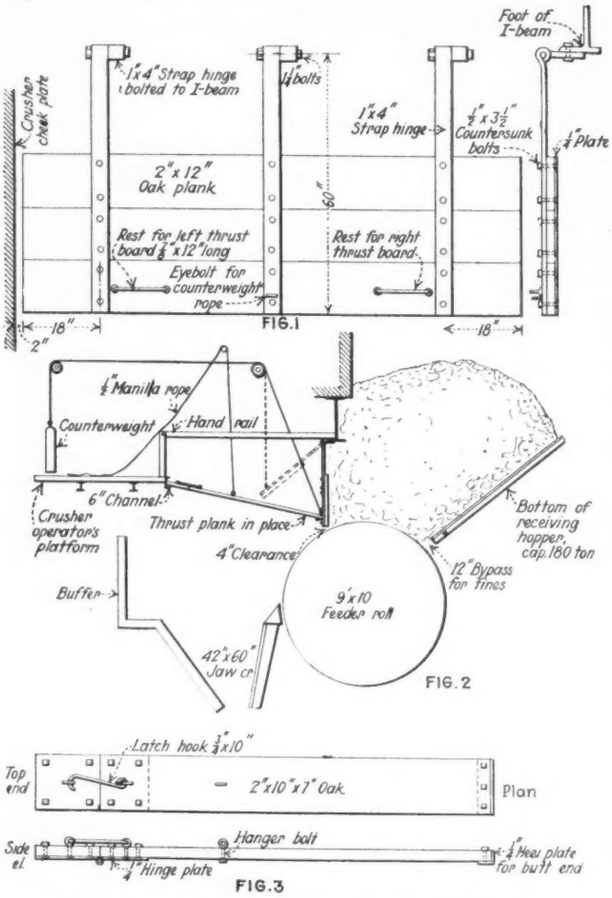
Design of Crusher Feed Gate

By H. H. Hunner

The gate shown in the accompanying illustrations was designed for the open pit primary crusher plant at the Cornwall mines at Cornwall, Pa., in which a 42x60-in. jaw crusher is served by a 9x10-ft. roll feeder. Like many other plants using big crushers, no provision had been made to utilize the storage capacity of the receiving hopper above the crusher at times when the crusher was clogged up. With the receiving hopper half full or more, and the 5-ft. clearance above the roll feeder entirely filled, no additional cars could be dumped into the hopper while the crusher was blocked, without endangering another slide of material into the crusher, thus causing further delay in clearing it. The vibration in the crusher building would frequently start a fresh slide when the crusher men were clearing a clog-up, and as a consequence they had to be on the alert to avoid being caught. To save time and work effectively, they would often take chances in placing the 5-ton air lift hook used in clearing the crusher. As the crusher could not be started under load, the hopper had to be cleaned down at the close of a shift, for fear of a slide starting between shifts. The hopper was thus of no use as a storage on shifts when the crusher was not working. In the rush seasons one shovel would be operated second shift to load all empty cars and the hopper storage would have been advantageous.

To avoid all train delay at the crusher due to clog-ups, and as a safety measure for the crusher men, the gate shown in Fig. 1 was designed. As ore falling from a car into the empty hopper slid about 30 ft. on a 45-deg. slope, rail lined (see Fig. 2), a considerable portion would gush out over the hump of the roll, and strike the buffer before falling into the crusher. In handling chunks that weighed 5 to 6 tons, the gate would thus have to withstand severe shocks. The gate was designed

principally to stop the first rush of ore, mostly fines and medium-sized chunks. As these built up back of the gate, the impact of the big chunks that followed would be taken up. Clearance for using the 5-ton air lift, which was kept on the right-hand side of the crusher when not in use, had to be provided. The gate could



Figs. 1, 2, 3—Details of crusher feed gate

thus only be propped on the left side, except between shifts, when two thrust planks were used.

In the closed position, the gate has about 4-in. clearance at the bottom, and 2 in. at the ends. This allows the first rush of fines to slide under and around, and gradually stop, building up behind the gate. One thrust plank held the left side of the gate in place, the thrust plank buckling more or less and the operators' platform springing also. The right-hand side would move outward 4 to 6 in., warping the entire gate as the full impact of the slide of rock was checked.

To save the gate as much wear as possible when not in use, it was swung to a 50-deg. slope by a counterweight suspended by a ⅝-in. wire rope. Only the very large chunks would strike the gate in this position, and the counterweight would aid in clearing the gate and in relieving the shock of flying chunks. It was found that the gate was also of assistance in turning long slabby chunks that formerly slid down and bridged the crusher jaws. The gate was heavy enough to deflect the long slabs directly into the jaws.

The gate was closed whenever a clog-up took place and a train had to be dumped, or for safety in working over the crusher. The operator places the butt end of the thrust plank on top of the left cross-piece on the gate, and placing his foot against the top end, shoves the plank over the edge of the platform, where it is caught in the 6-in. channel. This requires only a few seconds and the air signal is then blown to dump. On clearing the clog-up, the latch on the upper side of thrust plank is knocked open and a slight pinch with a bar under the hinge is sufficient to spring the plank and release the gate. A ½-in. manila rope passing over a pulley above the crusher to the operator's platform is used to recover the plank (see Fig. 3).

The arrangement, although rather crude, worked very well and required little repair. I do not believe air-plunger operation of the gate would have been successful, as any resistance to the impact of occasional big chunks would have required constant repairs. Flying chunks resulting from blasting in the crusher would have made a target of any mechanical device. The thrust plank was cut out about every three or four months by blasting.

The 2-ft. clearance above the gate gave the feeder-roll operator a good view of the ore passing over the roll, and allowed the escape of powder gases and small chunks of ore when blasting a block up over the roll. The gate also gave a good support for a 10-in. plank slid out from the operators' platform when drilling a big chunk or placing powder for a chamber shot over the roll, and made it possible to examine the clog-up in safety at close quarters.

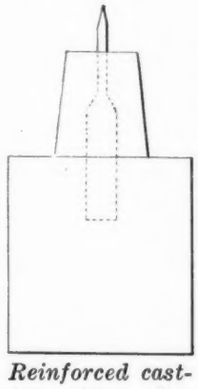
During two years' operation repairs consisted of a half dozen or more broken hinges which were welded, and a new 2x2-in. bottom plank. The constant twisting of the hinges would cause them to fail about half way between the hangers and the top of the gate. A new hinge could be put in during the half-hour lunch period. An occasional blast over the roll close to the hinge would cause it to snap. The crusher gate practically eliminated all train delay at the crusher, and minimized the accident risk. It added 200 tons storage capacity to the empty car service when the crusher was down for repairs, or on those shifts when the crusher was not working.

Design of Cast-Iron Stamp Shoe

By Frank Cooper

Mill Superintendent, Minas del Tajo, Rosario, Sinaloa, Mexico

The accompanying sketch illustrates a design of cast-iron stamp shoe that has given excellent service. To prevent a cast-iron shoe from breaking at the neck, a piece of discarded shafting, 1½ or 1¾ in. in diameter by 8 in. in length, is drawn roughly to a point at one end, or else is drilled and tapped for a ⅝-in. pointed rod. The pointed end is thrust into the bottom board of the mold and the casting poured in the usual manner. When removed from the mold, the projecting end of the rod is cut off. Shoes cast in this manner wear down to less than an inch in thickness and neck breakages have disappeared.



Reinforced cast-iron stamp shoe

The shoes weigh 72 kg. and have an average life of 60 days.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

IMPROVEMENTS at the Copper Queen smelter of the Phelps Dodge Corporation at Douglas, Ariz., made necessary by increased receipts of flotation concentrate, will cost $1,500,000.

Fifty-four silver mining companies will have a hearing on July 13 at Washington, D. C., on the question of readjusting back income taxes.

Good results are being obtained by the Sheldon Mining Co. in its new flotation plant at Walker, Ariz. Two concentrates are made.

A new company capitalized for 75,000,000 francs will undertake the construction of the Lufira hydro-electric plant to supply the Union Miniere with power.

Passing of the Tonopah Extension dividend is explained by the bad conditions in the mine.

A regular and an extra dividend, to be paid June 29 by the Tintic Standard Mining Co., brings the total to date to $4,803,964.

Administration of mineral land leasing has been transferred from the Bureau of Mines to the Geological Survey.

Regular shipments of concentrates are being made by the Holly Consolidated from the Eureka district, in Nevada.

Renewed activity with two regular shippers is reported from the Royston district in Nevada.

Callahan Zinc-Lead Has Good Shoot in Galena Mine

Samples Show 11.4 per Cent Lead; 9.6 Oz. Silver—Company Controls 2½ Miles on Strike

What appears to be the most important strike in the Coeur d'Alene region, in Idaho, for several years has been made in the Callahan Zinc-Lead Co.'s Galena mine, two miles west of Wallace.

On the 1,000 level an ore deposit 21 ft. wide has been exposed. Appearances indicate the presence of ore of shipping and milling grades.

The original shoot was 6 ft. in width, showing low-grade ore. What appeared to be a wall at that time has since proved to be ore of similar grade. Beyond the wall is the greater part of the ore channel, said to be 21 ft. wide; 4½ ft. is of the same milling grade as was found in the first 6 ft.

Samples taken across the 6 ft. contain 11.4 per cent lead and 9.6 oz. silver, and a selected sample contained 41.6 per cent lead and 31.9 oz. silver.

Charles W. Newton, general manager of the Callahan company, says that after a drift is run east and west on the ore, a winze will be started to attain additional 200 ft. of depth for further exposure of the shoot.

Cyrus Gossert and associates, operating as the Chicago-Boston Mining Co., developed ore in the Galena mine several years ago. Ore then in sight was increased by the Day interests, who allowed their bond on the property to lapse in 1917.

Mr. Newton recommended the acquisition of the property to the Callahan company. Since its purchase the company increased its holdings in the dry belt, west of Wallace, by acquiring the property of the Wallace Mining, Milling & Realty Co., adjoining it on the east, and the Argentine Mining Co., adjoining on the west, and now holds, including the Chicago-Boston and Killbuck groups, comprising the original Galena mine, 2½ miles along its vein system, extending from the Wallace city limits west, and containing upward of 1,200 acres. Fifty men are employed in development work.

Picher Zinc Mines Grew Rapidly in Ten Years

Ten years ago there were no mining operations in what is now the town of Picher, Okla., in the Joplin-Miami field, except the development operations then under way by the Eagle-Picher Lead Co. What a tremendous amount of ore has been taken out since then is indicated by a map, recently published in the district, which shows that a person can descend into the ground at the Eagle-Picher Co.'s Hunt mine, northwest of the town, and visit the following properties without once coming to the surface: Cortez; Underwriters Land Co.'s No. 1 and No. 2; St. Louis S. & R. Co.'s No. 1 and No. 2; Black Eagle; Cosmos; Jeff City; Lucky Kid; Mahutska; Bingham; Black Hawk; Premier; Oko; St. Joe; Vantage; Golden Rod; Manhattan; and H. & M. The last-named mine is about three miles from the Hunt.

New Sheldon Mill at Walker, Ariz., Does Good Work

Lead and Gold-Copper Concentrates Made—Will Sink Shaft to 1,000 Level—Much Water

The Sheldon Mining Co., at Walker, Ariz., is now operating its new flotation mill successfully. The mill was designed by David Cole of El Paso, for the treatment of the lead-silver-gold-zinc ores found at depth in the mine. The surface ores on the Walker district in general contain free gold, but after approximately 100 ft. in depth is reached, the gold is found associated with the pyrite and copper, and the separation of these minerals from the lead constituted a metallurgical problem which, until recently, has retarded the development of the property. The mill contains a gyratory crusher and rod mills, Minerals Separation cells, and Wilfley tables, and a very satisfactory separation is made of the lead from the copper and gold-bearing pyrite. The concentration is only three to one, owing to the high percentage of pyrite. The lead goes to the El Paso smelter, while the copper and pyrite is handled at the Humboldt smelter. The mill has a capacity of 180 tons when operated for a twenty-four-hour shift, and a very good recovery is obtained.

The mine is at present down to the 850 level, and present plans contemplate sinking to the 1,000 level.

All concentrates from the mill are piped about 4,000 ft. to a drying plant, where they are loaded into small cars and taken by an electric motor through a tunnel from the town of Walker to the old town of Poland for shipment.

Phelps Dodge Will Spend $1,500,000 on Copper Queen Smelter

Improvements Necessary as Consequence of Starting Warren Flotation Plant at Bisbee—Blast Furnaces Will Be Held in Reserve

By George J. Young
Associate Editor

THE RECENT ANNOUNCEMENT of extensive improvements to be made at the Copper Queen smelter at Douglas, Ariz., is further amplified by the following information:

The estimated cost of the improvements is $1,500,000. A pulverized coal equipment is to be installed for supplying the reverberatories. Definite decision as to the commercial equipment to be used has not been made, but the designs call for the elimination of any storage of the pulverized coal and the use of driers, thus minimizing the danger of dust explosions. The coal to be used in the pulverizing plant will be supplied by the Dawson colliery of the company. The mine-run coal averages 4½ to 5 per cent moisture, and it is expected that this moisture content will be reduced sufficiently in handling to make feasible the omission of driers. It is planned to grind the coal in a stream of heated air. A ball mill is to be used for grinding, experiments having been conducted with this type of grinder.

The waste-heat boiler equipment of the reverberatory furnaces is to be doubled. The vertical type of Erie boiler will be used. The design of this installation is such as to secure the highest efficiency and the least amount of attendance and upkeep. Twelve Queen type roasters (nine calcining and one drying hearth) that were developed at the smelter are to be installed. This type of roaster has been thoroughly tried out and its use has been found to result in minimum supervision and upkeep.

A new type of leakage-proof car has been designed for handling the hot calcines from the roasters to the reverberatories. The cars will be heat insulated and will be made as near leakage and spill proof as possible. A Cottrell plant or a By-products Recovery Co.'s. installation will be put in to handle the roaster gases and dust. The present crushing plant is to be enlarged. The feed floor and slag disposal trackage of the reverberatories has been redesigned to accord with modern requirements.

The present system of coarse ore handling will be altered by first crushing the ore to ⅜-in. size and bedding it with the concentrates. Sufficient moisture will be added to reduce dust losses to a minimum. The bedded material will be reclaimed by steam shovels as at present in use on the coarse ore storage pits. An unloading pit will be constructed near the roasters to take the mixed product for delivery to the roasters by conveyors and elevators.

The changes in equipment and design were forced upon the smelter management by the increased amount of flotation concentrates from the Warren mill. It is now planned to handle all of the Bisbee product in the three reverberatories under normal market requirements and to retain the blast-furnace installation for use in supplying an increased demand for copper. The converter plant will not be changed. The engineering design for the improvements and reconstruction is in charge of A. G. McGregor, of Warren, Ariz., and the actual construction work is to be done by a contract under the supervision of the Copper Queen smelter staff.

In addition to the work of planning the remodeling of the Copper Queen smelter, a great deal of work has been done during the past year in investigating the fume losses in copper. Since the advent of flotation concentration, the handling of flotation concentrates has resulted in stack losses, which were, under past conditions, negligible, but which are now appreciable and warrant specific efforts to control. The copper smelters' problem has thus been further complicated by the necessity of treating finely divided material.

Windstorm Damages Waco Elevators; Cut Zinc Production

A destructive windstorm visited the Waco mining camp in the Joplin-Miami zinc and lead district on night of June 1, causing a good many thousands of dollars damage to mining properties and bringing about enforced curtailment of output of high-grade zinc ore.

At its High Five mine the American Z. L. & S. Co. lost a dummy elevator. The Acme Lead & Zinc Co. had its dummy elevator blown over onto its concentrator. The Tulsa-Pittsburg Co. lost a tramway. The Barnsdall Zinc Co. lost a dummy elevator at its No. 2 mine, and the same sort of trouble befell the Childress-Bai Lihme mine. There was also slight damage at the Grasselli No. 1 mill.

Cleveland-Cliffs Starts Siliceous Ore Mining at Ogden

The Cleveland-Cliffs Iron Co. has started operations at the old Ogden mine, south of Ishpeming, on the Marquette iron range, in Michigan, and shipments are now under way. It is an open pit, the ores being of siliceous type and low in iron. There is very little phosphorus and little manganese, and ores of this character are in good demand this season. The mine was opened during the early days of the range, and the last work was done there in 1905. The time is not far distant when the low-grade ores will be wanted in larger quantities, as the ores of better grade are rapidly being mined and the supply is limited.

New Concentrator Planned for Waco Area by Acme

The Acme Mining Co. has begun the construction of a modern 300-ton concentrator on its lease in the Waco, Mo., section of the Joplin-Miami field.

The new mill will be electrically equipped, and modern throughout. It will be used to take the place of the original Acme mill, which was one of the first erected in the Waco camp. The new mill will be located 100 ft. northeast of the old mill.

The building of this new mill is practical evidence of the value of the lower run of ore in the Waco field. At one time there were no operations in that section below 200 ft. In recent weeks the Acme company has opened seven drifts in its property at a depth of 280 ft., and the showings in these drifts are responsible for the decision to build the new concentrator. L. P. Buchanan, of Joplin, is general manager for the Acme and Butte-Kansas mines in the Waco field.

Trail Ore Receipts 162,281 Tons for Five Months

Shipments received at the Trail smelter, in British Columbia, during the first five months of this year totaled 162,281 tons, of which 153,438 tons came from the Consolidated Mining & Smelting Co.'s mines. Though the tonnage is less than for the similar period of last year, a larger proportion arrived in the form of concentrate, and consequently the metal content was greater.

The following were the shippers during the last ten days of May: Apex, New Denver, 14 tons; Blue Ridge, Northport, 38 tons; Emerald, Salmo, 49 tons; Knob Hill, Republic, 112 tons; Lucky Thought, Silverton, 33 tons; Molly Hughes, New Denver, 10 tons; Mountain Chief, New Denver, 27 tons; Ruth-Hope, Sandon, 41 tons; Roseberry-Surprise, New Denver, 30 tons; Sally, Beaverdell, 49 tons; Silversmith, Sandon, 245 tons; Consolidated Company's mines, 7,994 tons.

Holly Consolidated Ships Ore and Concentrate From Eureka

New and important bodies of ore are being developed in the Eureka Holly and Bullwhacker mines, controlled by the Holly Consolidated, in the Eureka, Nev., district. The most important discoveries have been made on the 500 level of the Holly and the 400 level of the Bullwhacker. Regular mining has been carried on above the 600 level, and the major portion of the mill tonnage is being produced from this section.

The 100-ton mill has not been operating at capacity, due to shortage of water, but it is thought that work on the lower levels will increase the flow to such an extent that maximum tonnage can be handled.

Production for the last half of May was valued at about $20,000, and during the first week of June 60 tons of concentrates valued at approximately $100 per ton, and 48 tons of silver-lead ore were shipped.

The Prince Consolidated and the Virginia-Louise Mines at Pioche, Nev.

These mines have produced several hundred thousand tons of fluxing ore for Salt Lake smelters. Work is actively under way to determine the potentiality of the lower limestone and quartzite which in the older portion of the Pioche district produced over $25,000,000 of bonanza ore. The Virginia-Louise shaft and dump are in the right background.

Three New Mills in Arizona Reflect Fair Activity

All Small Plants — McCracken Mill Making 50 per Cent Lead Concentrate

Increased activity of the smaller operators in the precious metal districts of Arizona is to some extent counterbalancing the curtailment of copper production by the state's larger producers. The old McCracken mine, in the southern part of Mohave county, is producing steadily under the control of the Signal Mines Corporation. A 600-ft. shaft has recently been sunk and a 150-ton mill erected. The mill is equipped with a 50-hp. Fairbanks Morse hot-head engine, coarse and fine crushers, a Marcy rod mill, Dorr classifiers and settlers, Minerals Separation flotation cells, Oliver filter presses, and concentration tables. The mill is sending out an average of 12 tons of concentrates per day, averaging 50 oz. silver and 50 per cent lead. The concentrates are hauled by trucks to the Santa Fe railroad at Yucca station, 37 miles from the mine.

The United Western mine, in the Oatman district, has cut a vein of mill-grade gold ore 19 ft. thick on the 500 level. The Katherine mine at Kingman is reported to have struck an 8-ft. vein of high-grade gold ore in a raise between the 200- and 300-ft. levels at a distance of about 600 ft. from the shaft. The new mill at this property is expected to be in operation soon after July 1.

In Yuma county, the Wenden Copper Co. has started sinking its new shaft, which is to go to a depth of 1,000 ft. It has been named the Barkdoll shaft in honor of I. H. Barkdoll, superintendent of the O. D. mine at Globe. Mr. Barkdoll was formerly superintendent for the Wenden Copper Co. and is still a large stockholder in the company.

A 50-ton flotation mill is to be constructed at the Little Mary mine, in the Babocomi district southwest of Tucson. This mine was recently sold to the present operators, the Coma Pima Mining Co., by the Stepp brothers, who have been operating the property for the past nine years. A 75-hp. type Y hoist and a 320-cu. ft. compressor have been installed. A 250-ft. shaft is to be sunk by the new owners.

Bristol Silver Will Install Hoist; Possibly Diesel Engine

The new orebody struck on the 900 level of the Bristol Silver Mines Co.'s property near Pioche, Nev., is opening up rapidly. Drifting along the strike of the deposit for a distance of 100 ft. and cross cutting 20 ft. has not found the limits of the mineralization. Shipments are averaging 20 oz. of silver to the ton, 12 to 15 per cent lead, and 2.5 per cent copper. The management is of the opinion that the ore will persist from the 900 to the 100 level.

Considerable production has come from other fissure intersections on the 900 level, but ore was not as high in grade as that now being produced.

The company is planning to install a new electric hoist to increase production. Electrical power will either be brought from Pioche, or a Diesel engine will be installed at Jackrabbit, the railroad loading station 8,000 ft. distant, to generate electricity for both the Bristol and the Black Metal mines.

Jones & Laughlin Drill for Ore in Iron River Area

The Jones & Laughlin Ore Co. has started drilling on several forties of land that have been optioned from the Keweenaw Association, in the Iron River district in Michigan. One diamond drill has been started, and more will be added. The lands in question are to the southwest of the Cardiff mine, and it is believed they contain an extension of the ore formation on which the Forbes, Davidson, and Cardiff mines are at work. There is very little surface diamond drilling being carried on in Michigan at present, one reason being that orebodies disclosed are immediately taxed as such.

Reopen Dorotha Morton Mine

A Vancouver syndicate is reopening the Dorotha Morton mine, at Phillips Arm, British Columbia, and has found rich gold ore in the old workings. The mine has been closed for 25 years. Ore is being mined from the old workings and the syndicate has started a tunnel to develop the vein at a depth of 400 ft. A tractor and trailers have been shipped to the property to transport ore to the coast for shipment to a smelter, probably Tacoma.

Tonopah Extension Passes June Dividend to Conserve Cash

May Bullion Shipments Only $56,000— Caves in Mine Obstruct Current Operations

At a meeting on June 9 of the board of directors of the Tonopah Extension Mining Co., which operates at Tonopah, Nev., the regular 5c. dividend for the second quarter of 1925 was passed. The directors' statement was to the effect that, due to bad mine conditions at the present time, it was deemed for the best interests of the company to conserve its cash position.

In April the company shipped bullion valued at $108,815.40, with operating expense for the month of $111,758.98, resulting in an operating loss of $2,943.58. During May, bullion production amounted to about $56,000, which would indicate an operating loss for the month of around $50,000.

The balance sheet as of March 31, the end of the fiscal year, showed liquid assets of $875,880.82, of which $173,718.39 was cash, $486,897.77 interest-bearing investments at cost, $181,276.60 accounts receivable, and $33,988.06 bullion in process. This shows the company to be in a strong financial position, and well able to withstand the necessary expense of development around the caved area and into the virgin wet territory to the west of present workings.

U. V. X. Pays $278,889 on 1924 Tax; Not Enough

The United Verde Extension Mining Co. has recently made a payment of $278,889 to the county treasurer of Yavapai County, Ariz., in payment of taxes for 1924. The company considers this sum to be the correct total of its taxes for the year, but the county places the amount due at about $61,000 more than the amount paid. The mining company has made the payment without conditions or restrictions, but objects to paying the additional $61,000. County officials have accepted the payment which the company has offered, but announce that suit will be brought to force payment of the additional amount when the period of delinquency, as stipulated by law, amounts to sixty days. Another tax suit brought by the mining company against the county over 1922 assessments is now pending.

News From Washington

By PAUL WOOTON
Special Correspondent

Silver Miners to Have Day in Court on Income Tax Question

Federal Revenue Officials Name July 13 for Hearing -Kriegh Outlines Views on Situation

FIFTY-FOUR silver-mining companies have been notified that they will be heard on July 13, at the office of the Commissioner of Internal Revenue, Washington, D. C., on the question of revaluation of their mines for purposes of computing invested capital and depletion allowances in connection with federal income taxes.

The principal question to be considered is as to the price factor to be used in determining property values as of March 1, 1913. The revenue bureau first used a price of 65c. per ounce in estimating expected gross earnings, but is now proposing to substitute a price of 57.78c., which will greatly reduce the valuations and increase the tax liability of the companies for 1919 and subsequent years. Other questions as to ore reserves, grades of ore, and mining costs also have been raised and presumably will be considered.

McKinley W. Kriegh, chief of the tax division of the A.M.C., advocates a comprehensive review of the entire industry, outlining its problems and difficulties, and the presentation of specific cases showing in detail the absurdity of some of the results heretofore reached by the department's engineers. He thinks that the lack of knowledge on the part of department engineers of particular properties should be stressed, laying emphasis upon the fact that the prime requisites of an accurate valuation are: Personal knowledge of the property and the district, practical experience, sound judgment, and the consideration of all factors involved, instead of a selection of only those which give lowest value. Also attention should be called to the unnecessary data requested by the department, and the great expense and annoyance to which the taxpayer has been subjected. The department's methods should be made clear by actual illustration, and it should be made plain that a change of methods and simplification of procedure are urgently needed. It should also be shown that minor corrections in valuations bring only expense and annoyance to both government and taxpayer. The absurdity of too many refinements, made without a sound knowledge of the case, also should be mentioned.

Attention is called to the fact that during the hearings of the Couzens committee the head of the Metals Valuation Section stated that the fixing of the price of silver as of the basic date at 65c. was "pure guess work." It should be possible to show that this is not a fact by statistics and price trends. As to future prices, the subject is one of opinion.

Mr. Kriegh contends that if the position of the Treasury Department cannot be changed in the matter of revaluation, the industry should insist that competent, impartial, and experienced practical engineers be appointed from the outside to study and pass upon the present methods of valuation now used by the department. After a careful study, these men should make their recommendations to the department as to necessary changes in methods, policies, and procedure.

There should be a special review board within the Engineering Division, composed of one or more of the most experienced and practical men from each section and under the control of the head of the Engineering Division. The review board, with the head of the Engineering Division, should have ample authority to act and close cases on an equitable basis, and should not be hampered by too many restrictions.

It is pointed out that one set of officials after careful consideration assigned certain values to the silver properties; that another set of officials now hold the opinion that their predecessors erred and that the properties were worth at the basic date about one-fourth of the values assigned to them; that there is nothing to protect either the taxpayers or the government against the opinions of the successors of present bureau officials. Should they be of the opinion that the valuations are all wrong and full of glaring errors of judgment, there is nothing to prevent a repetition of the revaluation.

Tintic Standard Dividends for 1925 to Date, $1,268,206

A dividend of 40c. a share, 20c. regular and 20c. extra, will be paid by the Tintic Standard Mining Co., operating at Eureka, Utah, on June 29 to stock of record June 23. This disbursement, a total of $461,166, will bring up total disbursements to $4,803,964. The last dividend, also of 40c. a share, was paid March 30. The March disbursement of $461,166 and the special dividend of $345,874 on Jan. 2, with that to be paid on June 29, make a total of $1,268,206, a sum exceeding total disbursements for the whole of 1924.

The company has purchased the Iron Blossom mine, also in the Tintic district, for a sum aggregating $375,000, also stock control of the Colorado Consolidated, and a substantial interest in the Dragon and Empire mines of the Knight Investment Co., deals involving a sum in excess of $200,000. The company now has about $3,000,000 in its treasury in the form of cash and government bonds.

Geological Survey Gets 115 Men and $400,000 Appropriation From Bureau of Mines

Leasing of Mineral Lands Transferred —Naval Oil Reserves to Be Administered by Survey

Administration of the minerals leasing act, formerly lodged with the Bureau of Mines, has been transferred to the Geological Survey. This function of the Mines Bureau very obviously had to be left in the Interior Department, it is pointed out, since that department has supervision over all public land matters.

Some are of the opinion that this duty should have been transferred to the General Land Office, but Secretary Work realizes that a technical bureau is better equipped to handle this work, which has many economic and scientific phases.

It will be recalled that the Geological Survey was concerned largely in the situation that led to the initiation of the leasing legislation. As a result of this transfer the Survey gains more in appropriations and in personnel than it has lost in the detaching of its Mineral Resources Division. In announcing the transfer of the leasing work, the following statement was issued from the office of the Secretary of the Interior:

"Placing the administration of the physical operations on leased oil, gas, coal, and other mineral lands belonging to the government under the Geological Survey continues the policy of having the nation's real estate handled by specialists. This bureau already performs important functions in connection with the issuance of permits and leases through its examination of public areas to determine whether they contain workable mineral deposits. The transfer thus will result in close co-ordination between the leasing and land classification duties of the Geological Survey, simplifying and expediting the work."

Included in Secretary Work's transfer order is the Red River oil field on the Texas-Oklahoma border, which has been operated by the Bureau of Mines and which will be turned over to the Geological Survey to continue its operation. The leasing work performed by the Bureau of Mines in Alaska is also transferred to the Geological Survey and is combined with the mineral investigation duties of the Geological Survey in that territory.

The supervision of operations for the benefit of the navy on naval oil reserves in California and Wyoming heretofore performed by the Bureau of Mines will, so long as desired by the Secretary of the Navy, also be handled by the Geological Survey. As the director of the Survey is chairman of the President's Naval Oil Reserve Commission, this new assignment of field supervision is also in the line of better co-ordination of important work.

The number of employees involved in the transfer is approximately 115, with appropriations and allotments totaling around $400,000. The larger part of the work is conducted from a dozen field offices in the Western states.

Develop Roast for Silver-Manganese Ore Prior to Cyanidation

Caron Process Investigated by Bureau of Mines—Works Successfully in Netherland East Indies

Successful treatment of certain classes of silver ore containing manganese by the use of the Caron process is reported, according to Bulletin 226, just issued by the U. S. Bureau of Mines, which has been co-operating with the Netherlands East Indian Government in investigating the process. When oxidized ores containing a refractory compound of silver and manganese are heated in a reducing atmosphere—so as to reduce completely the higher oxides of manganese to manganous oxide—and are cooled under conditions that will prevent reoxidation, it has been found that the refractory compound is decomposed and the silver is rendered amenable to cyanidation. This treatment, in combination with cyanidation, has been demonstrated through tests of typical samples from widely separated localities to be the most effective treatment for many manganese-silver ores. The Clevenger furnace and cooler unit has been developed, whereby reduction can be obtained with high fuel economy, and reversion to the refractory state can be prevented.

On account of the intimate association of the manganese and silver, all methods of concentration and direct lixiviation of the raw ore have been proved unsuitable; as are also all methods of lixiviation of ore calcined under oxidizing conditions. Ores that contain antimony are the only exceptions that have been found so far.

Producer gas of 150 b.t.u. or higher, made from any fuel—coal, coke, wood, oil, or charcoal—may be used. Gas of higher grade can be used, and in some places might be found advantageous. All of the fuel used can be gasified to meet the requirements of the reducing zone and the remainder burned directly in a combustion chamber between the preheating and the reducing units of the kiln.

Although there are exceptions, most ores can be reduced in a coarse condition—that is, in sizes from 1 to 2 in. It is necessary to establish the best temperature of reduction for each ore by a series of tests. In general, this temperature is at some point between 500 and 700 deg. C.

The percentage of unaltered manganese dioxide should be determined after the ore is calcined, and perhaps at a later stage in the cyanide treatment.

The use of enough air during grinding and agitation is of value in neutralizing the mild reducing effect of the manganese oxide. The silver extraction from ores yielding 60 per cent or lower by other methods may be increased to 88 to 96 per cent, depending on the character and grade of the ore.

The gold in some manganese-silver ores is amenable to direct cyanidation, and in such ores its extraction is not increased by reduction. In other ores the gold follows the silver, and is more or less refractory; in such ores the recovery of gold is increased to an even higher percentage than that of silver.

Silver ores in general show a higher consumption of cyanide than gold ores. Manganous oxide is not a cyanicide, nor has there been found manganese in the solution resulting from the treatment of a reduced ore. Some ores seem to consume no more cyanide after reduction than before, or no more than can be accounted for by the additional silver dissolved; other ores consume decidedly more cyanide after reduction. The increase has been found to be due to the presence of base metals in combination with manganese, like the silver. They are freed like silver, by reduction, and are likewise dissolved by the cyanide solution.

The process can be most economically applied to daily tonnages of 200 or above. For lower tonnages the cost of installation and operating would be somewhat greater. In a given locality the direct cost of the process would not differ greatly from the cost of dead roasting a low-sulphur ore.

Joplin-Miami Development Active Despite Moderate Zinc Prices

Although ore prices are not very attractive in the Joplin-Miami zinc and lead district, production capacity seemingly being slightly better than demand, there continues to be steady development.

The Federal Mining & Smelting Co. is opening two shafts on the Dobson lease, in the Picher, Okla., camp. William Leffen, George Meese, and associates of Joplin are making arrangements to reopen the English-O mine, west of Baxter Springs, Kan. The Portland Mining & Milling Co. is using two walking-beam pumps to drain the old Scarlet Kid mine, west of Galena, Kan., and expect to start active mining operations. A drilling campaign has been under way for some time.

Homer Seals, one of the best-known "salvaging" mine operators in the Joplin-Miami district, has recently taken over the Cherokee Development Co.'s property east of Hockerville, Okla.

The Domado Mining Co. is planning the construction of a new mill to be located on an 80-acre lease northwest of Quapaw, Okla.

The Barnsdall Zinc Co. is sinking a new shaft on its property west of Cardin, Okla. The Pittsburgh Mining Co. has taken an option on the Jack & Jill lease, located west of Cardin.

No Worse for 60-Hour Stay Behind Caved Ground

Robert Hill, a miner employed at the Baltic mine, Grass Valley, Calif., was trapped by a cave in the mine adit. The cave occurred shortly after several miners had left the working and before Hill started out at the end of his shift. When he attempted to leave the mine by the usual route, he encountered the cave. His absence was quickly discovered and his companions returned and discovered the cave. Work to remove the obstruction started at once and was completed after Hill had been retained a prisoner for sixty hours. The hungry miner suffered no injury and rejoined his anxious family.

Toronto Letter

By Our Special Correspondent for Northern Ontario

More High Grade in Tonopah Mining Co.'s Property

Developing Walsh Property at Gowganda—Ore in New Nipissing Shaft at Cobalt

Toronto, June 20—Another new high-grade vein 6 in. in width has been found on the Walsh property in Gowganda, which is under option to the Tonopah Mining Co. of Nevada. This is the third high-grade vein to be found to date, but the company is say-very little about its discoveries, as it has been negotiating for other ground. The Tonopah company has optioned the Canadian-Gowganda and the Morrison groups, which lie close to the Walsh. The latter property should be on a regular producing basis this year.

The first discovery of silver has been made in the new 407 shaft of the Nipissing, which was put down to a depth of 345 ft., to explore the conglomerate underlying the diabase. The vein is of minor importance, but indicates that development work is in ore-bearing ground. Another discovery has also been found on the 400 level of the McKinley-Darragh that shows good silver values. Production for May was approximately 50,000 oz., which is considerably in excess of the previous month. The Menago property is again shipping at the rate of about 1,500 tons a month, and the grade is understood to be 30 oz. per ton.

In May the Keeley mine at South Lorrain produced 124,911 oz. of silver, which is the average production. At the Penn-Canadian mine, which is now controlled by the Doherty-Easson syndicate, the mill has been started up and is treating about 100 tons a day. This is the first time the mill has been operated since 1919, and at the time the property was closed down there were several thousand tons of low-grade ore broken. The syndicate has started diamond drilling to explore the eastern part of the property.

During the month of May the Lake Shore mines of Kirkland Lake produced $160,000, the average daily tonnage being 296 tons. It is understood that the management contemplates further increase in the mill capacity and it is believed that with comparatively small additions to the equipment the tonnage can be raised approximately 50 per cent. The crushing equipment is now being added to and the increased capacity should be obtained before the end of the year. This should give an output of approximately $3,000,000 a year, of which about 50 per cent would be profit. The capital of the company is $2,000,000.

Judgment has been given against the property of the Great Northern Power Co. to the Montreal Trust Co., which is trustee for the bondholders to the amount of $850,000. There was a default in interest of $29,750 due May 1. The company built a power plant on the Montreal River at Matachewan and built a transmission line into Porcupine. At the present time it is serving only the Night Hawk Peninsular and Coniarum mines. When the plant was

constructed, it was expected that the Matachewan camp would use a large amount of power and that the Davidson, with which the company also had a contract, would be a substantial producer. Neither of these two sources of revenue materialized and the present contracts will not cover operating expenses and bond interest.

New Yorkers Will Develop K. & M. Group Near Bishop, Calif.

Frederick C. Fearing and associates of New York have acquired a controlling interest in the Benton Mining & Development Co., owning the K. & M. group of twelve claims on Blind Spring Hill, 35 miles north of Bishop, Calif. Announcement of the transaction has just been made by W. A. Irwin, managing director, under whose supervision operation of the property has been resumed. To facilitate work, a two-drill air compressor has been installed at the mouth of a 300-ft. crosscut tunnel at the base of the hill. Present plans call for the extension of this tunnel an additional 800 ft. to cut at a vertical depth of 600 ft. the Keller and Pat Reedy ledges, which yielded a large tonnage of ore many years ago through shafts sunk to a depth of 300 ft. from the surface on their dip.

New Candelaria Mills 100 Tons Daily; Repairs Shaft

The New Candelaria Mines Co., operating the old Northern Belle and other mines at Candelaria, Nev., is milling about 100 tons of ore per day, with improving mine conditions that may justify an increase in tonnage in the near future.

The main shaft has been repaired and equipped from the 1,500 to the 1,700 level, and sulphide ore has been developed and is being mined in this section. Preparations are in progress to repair and equip the shafts to the 1,900 level, in order to develop the 1,700 level orebodies at that depth. Reports from the management indicate that general mine conditions are better than at any time since work was resumed.

Park-Bingham Ships Lead-Silver Ore From New Shoot

Four carloads of ore were shipped from the Park-Bingham Mining Co.'s property at Bingham, Utah, during the week ended June 13. Three of these carloads were derived from the new strike made in the Sanford raise, 175 ft. above the Butterfield tunnel, which traverses the Park-Bingham property and connects with the lowest levels of the adjoining United States mine.

The ore being followed in north and south drifts from the top of the Sanford raise consists of a fissure deposit ranging from 3 to 4 ft. wide. Assays show about $1.50 a ton in gold, 13.6 oz. of silver and 27 per cent lead. Raising in order to explore the fissure in overlying limestone will begin at once.

In its Park City property, the company is drifting to the east along a well-mineralized fissure to reach the contact of the limestone and quartzite.

London Letter

By W. A. Doman

Special Correspondent

Union Miniere Backs New 75,000,000-Franc Power Company

Will Harness Lufira Falls—Current for Electrolytic Copper Precipitation in Congo

London, June 9—There is no doubt that the great copper proposition of the Congo known as the Union Miniere du Haut Katanga is thoroughly up to date. At the meeting held in Brussels last year it was announced that a scheme for the installation of a hydroelectric plant had been formulated, and, according to latest advices, this has now taken definite shape. A new company with a capital of 75,000,000 fr. has been formed, under powerful auspices, to harness the Lufira Falls for the development of power for the electrochemical treatment plant, which will deal with large quantities of low-grade ore. This apparently will not interfere with the Wankie Colliery, which is under contract to deliver fuel to the Union Miniere for at least the next five years.

It is interesting to note how mining activity in northern Rhodesia and Tanganyika is expanding. The Gold Fields Rhodesian Development has recently secured from the Chartered Co. and the Rhodesian Government prospecting rights extending over 5,000 square miles in northern Rhodesia and 500 square miles in southern Rhodesia, and prospecting parties have been despatched; also the Tanganyika Goldfields has been formed, under powerful auspices, to acquire forty-six gold claims in Tanganyika Territory (late German East Africa), on which Malcolm D. Caldwell has reported favorably.

What promises to be a new tin field has been discovered in the mandated territory of Southwest Africa. A small syndicate with £20,000 capital has been formed, and has acquired options over very large areas in the district, while W. H. Trewartha James, as I reported recently, is now examining the properties. His reports are of a very encouraging character, and the areas now being prospected should allow of the formation of several operating concerns. Owing to the statistical position of the metal and the possibility of a shortage, it is essential that new sources of supply should be discovered if the price is to remain even at its present level.

The late S. H. B. Blandy, who was an acknowledged authority on Eastern tin mining and a member of the Council of the Malayan Chamber of Mines, spent many years of his life in searching for new fields, and just before his death, on being shown the particulars of the new find, he expressed the opinion that his dreams had been realized. Moreover, it is understood that the Germans who formerly owned the country were aware of the existence of tin lodes, and German interests are now working one property in the neighborhood, with such satisfactory results from one mill that two new plants have been ordered for early installation.

I understand that John Saxton is shortly leaving London for the Gold Coast to take over the management of the Akim alluvial fields. He will be accompanied by G. W. Foster, who has had many years' experience on the Jos Bisichi and other West African properties. These engineers represent the recently formed Gold Coast & General Syndicate, which will float several subsidiary undertakings to deal with the huge diamondiferous territory belonging to Akim, Ltd. There is, by the way, an exhibit at Wembley where the whole process of recovery, cutting and polishing of West African diamonds can be seen in progress. The Nana Ofori Atta, the King of Eastern Akim, is a director of Akim, Ltd.

Rich Ore Being Shipped From Royston, Nev.

Renewed Activity—Canadian Leasing Co. Producing—Jones Develops Hudson Property

The camp of Royston, situated thirty miles northwesterly from Tonopah, Nev., is still producing and more development work is being done now than for some time. Several cars of high-grade silver ore have been shipped from the camp, and the original owners of the Betts lease made good profits. These leasers shipped $37,000 worth of ore before the oreshoot was faulted and temporarily lost. The Canadian Leasing Co. took over the Betts lease and after some development recovered the ore. This company is now stoping 300-oz. silver ore across a width of 6 in. to 3 ft., and is about ready to ship the first of several carloads estimated to be in sight.

On the Hudson property, A. H. Jones, former superintendent of mills for the Tonopah Belmont Development Co., is opening a rich shoot of ore on the 300 level from the main incline shaft. The ore is narrow but rich, and that now being saved will average $500 per ton. The Hudson mine has produced more than $40,000 worth of ore from small shoots, and is regarded as promising.

May Build Quicksilver Reduction Works Near Phoenix, Ariz.

The Arizona Quicksilver Corporation has recently acquired the Sam Hughes and the Quicksilver Queen properties in the Squaw Peak district ten miles north of Phoenix. The former property is said to contain a 6-in. vein of cinnabar ore averaging $25 a ton. The company plans to erect a 75-ton reduction plant. The corporation also controls several properties in the Sunflower district 70 miles north of Phoenix. Active development work is being carried on and plans are under consideration for the erection of a larger plant. The main drawback to the Sunflower district is its inaccessibility, but a road is now being surveyed to the locality from the site of the Horseshoe dam on the Verde River. The mines are situated on the logical route for a highway from Phoenix to connect with the Globe-Payson highway in the upper Tonto basin.

Societies, Addresses, and Reports

Engineering Education Meeting at Schenectady Well Attended

S. P. E. E. Elects Dean Pegram, of Columbia, President—Iowa City Selected for 1926

The thirty-third annual meeting of the Society for the Promotion of Engineering Education was held June 16 to 20 at Union College, Schenectady, N. Y. The attendance was about 350. It was of unusual interest due to the central feature, which was the preliminary report of the board of investigation and co-ordination, whose work is being financed by the Carnegie Corporation. The administration of the program was in charge of the president, Dean A. A. Potter, of Purdue University, and the secretary, Dean F. L. Bishop, of the University of Pittsburgh; while the local arrangements were looked after by Prof. F. P. McKibben, of Union College.

The formal program occupied two days, June 18 and 19, preceded by two days of well-attended special conferences and inspection trips, and followed by an all-day excursion on Lake George. Perhaps the most interesting of the details of the conferences were those relating to the following:

1. Statistical reports from the board of investigation and co-ordination, and the sub-committees working under its direction.

2. The informal report from the board's director of investigation on the status of technical education in Great Britain and on the Continent.

3. Conferences on the place of research as an adjunct to technical training.

4. Conference on the relation of engineering education to industry.

In addition to these major features, the convention was remarkable for the well-conducted special meetings of teachers of English, of electrical engineering and of industrial engineering, each group having programs comprising papers by eminent specialists and discussion of high order.

As to English, it appears that there is an increasing place for it in technical school curricula, largely due no doubt to the influence of alumni and employers of technical graduates. There is being rapidly developed a class of teachers of English who know what kind of instruction technical students need and who, while not engineers, are striving to get the engineering point of view.

As to electrical engineering, the teachers appear determined to render their instruction more effective by utilizing the stimulating effect of research.

As to industrial engineering, while there is not yet agreement as to teaching method, technical schools and industry are appreciating the need for engineering graduates who have a wide outlook upon industry and are better prepared to solve management problems.

An outstanding address, not on the program, was one on the great mathematician Oliver Heaviside, considered as a man rather than a mathematician, delivered by Ernst J. Berg, consulting engineer of the General Electric Co.

President Potter's retiring address was a masterpiece, on "The Engineering College—Its Opportunity for Service." It was broadcast, and reprints of it from the September issue of *Engineering Education*, the organ of the society, have already been made available. The address summarized comprehensively the viewpoint of the advanced, alert, engineering-school administrator.

Before the convention adjourned the decision was announced to hold the 1926 meeting at the University of Iowa, Iowa City. Resolutions were also adopted in commemoration of an unusual number of pre-eminent engineers, past-presidents of the society, who had died since the last meeting—namely, Mansfield Merriam, T. C. Mendenhall, F. W. McNair, and J. F. Hayford.

An amended form of constitution and bylaws was also adopted.

The following were elected to service for the coming year: president, Dean G. B. Pegram, Columbia University; first vice-president, Dean H. V. Carpenter, State College of Washington; second vice-president, Prof. F. P. McKibben, Union College; treasurer, W. O. Wiley, John Wiley & Sons, publishers; secretary, Dean F. L. Bishop, University of Pittsburgh; members of the council, to serve for three years, were also elected as follows: Dean C. H. Mitchell, University of Toronto; Major-General R. I. Rees, American Telephone & Telegraph Co.; Prof. J. A. Hunter, University of Colorado; Dean B. M. Brigman, University of Louisville; Prof. W. C. Hoad, University of Michigan; Dean G. M. Braune, University of North Carolina; Prof. Clair V. Mann, Missouri School of Mines.

Consulting Engineers Organize

The Association of Consulting Engineers of Canada, with head office at Montreal, has obtained a dominion charter of incorporation. The incorporators include James de Beaubien, Robert A. Ross, Arthur Surveyer, Henry Holgate, and James McC. Robertson. The purposes of the association are the promotion of ethical standards and practical efficiency in all branches of consulting engineering so as to increase the usefulness of the profession.

Bisbee Has Greenway Day

On June 9 friends, acquaintances, and former employees of General John C. Greenway, retiring manager of the Calumet & Arizona Mining Co., assembled at Warren and Bisbee, Ariz., to do him honor. The mayor of Bisbee proclaimed the day a holiday. Motorists from the adjoining towns of Douglas, Tombstone, Tuscon, Ajo, and other places helped swell the throng. A program of sports had been arranged, followed by dancing. General Greenway will make his future home at Ajo.

Chemical Society Proposed as Model for A.I.M.E.

Farewell Dinner Given at Washington to H. Foster Bain, Retiring as Head of Bureau of Mines

The American Chemical Society has been commended to H. Foster Bain as a model to follow in his efforts to strengthen the American Institute of Mining and Metallurgical Engineers. The recommendation came from D. F. Hewett, of the U. S. Geological Survey, in the course of remarks made at a dinner given by the Washington Section of the Institute, at which Mr. Bain was the guest of honor. The Chemical society, Mr. Hewett declared, is the most effective organization of professional men. Its efforts on behalf of chemists have been so conspicuously helpful that all members of the profession are attracted to its membership.

The dinner, at which George S. Rice, chief mining engineer of the Bureau of Mines, was toastmaster, was characterized as a farewell to the director of the Bureau of Mines and a welcome for the new secretary of the Institute, or, less elegantly, as put by Director Burgess of the Bureau of Standards, it was a wake and a birthday party combined in one.

David White, in referring to Mr. Bain's accomplishment in founding the Geological Survey of Illinois, declared that he gave it so much impetus that it is going yet. He revealed that he was well acquainted with the details of Mr. Bain's duties at the head of that agency and that they included writing speeches for the Governor. He reviewed his long acquaintanceship with the guest of honor and declared that Mr. Bain has left stronger and better every organization with which he has served.

Dr. F. G. Cottrell, former director of the Bureau of Mines, said that he performed his greatest service for that organization when he retired and induced Mr. Bain to take the job.

Director Burgess, whose bureau is a part of the Department of Commerce, said Mr. Bain is emulating Moses in having brought the bureau within sight of the Promised Land only to leave it.

Edward C. Finney, acting Secretary of the Interior, asserted that Mr. Bain's common sense and sound judgment had become one of the great reliances of the Secretary's office.

J. F. Callbreath, secretary of the American Mining Congress, pointed out that the regret occasioned by the loss of a good director of the Bureau of Mines is tempered by the fact that Mr. Bain is entering upon a field where he can be of even greater service to the mining industry.

Dr. Charles E. Munroe said that he had been very familiar with the qualifications of all the secretaries of the Institute and that no one of them was better equipped to do effective work than is Mr. Bain.

Dorsey Lyon, S. C. Lind, W. C. Mendenhall, J. W. Paul, and others paid high tribute to the work done by Mr. Bain and predicted that he would prove to be a great asset to the mining industry in his new position.

Engineering Museum's New Head Honored

Industrial Leaders Laud Samuel Insull at Luncheon in New York—Money Should Come From Private Sources, Latter Says

Samuel Insull, who was recently elected as president of the National Museum of Engineering and Industry, was honored at a luncheon of distinguished engineers and industrial leaders at the Bankers' Club, New York, on June 18. The organization is planning to raise a large sum of money for the construction of a museum building in Washington and have the necessary endowment for operating and administrative purposes.

Fred. R. Low, editor of *Power* and past president of the American Society of Mechanical Engineers, and Farley Osgood, past president of the American Institute of Electrical Engineers, both of whom spoke on behalf of the engineering societies, explained that the founder societies had formed a committee to confer with the museum organization and arrange for the support that should properly come to the movement from the great engineering societies. Mr. Low commented upon our carelessness in allowing the records of engineering to disappear and emphasized by contrast what the European countries had done in developing museums of engineering and industry.

Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, emphasized the view of the engineering colleges. He called attention to the great losses that had occurred through the destruction of models in early machinery and emphasized that the start should be made at once in arranging suitable places for assembling and displaying tangible evidences of engineering development.

The speakers were unanimous in congratulating the museum upon the selection of so able an organizer as Samuel Insull for its president. They felt sure, they said, that under his able guidance the objective in view would be attained. Mr. Insull, in responding, pointed out the help that can be rendered the movement by engineering societies, by manufacturers, and by the engineering schools. It was his belief that the money for the building should be raised by private interest, entirely if possible, and that the initial request upon the government, after funds are well in hand, should be for the site. The museum should preferably be allied with the Smithsonian Institution, he thought.

Congratulatory letters to the museum on the election of Mr. Insull were received from Herbert Hoover, Orville Wright, Elihu Thompson, Charles A. Stone, James H. McGraw, and Howard Elliott.

Among those present were: Elbert H. Gary, Thomas A. Edison, Charles A. Coffin, Otto H. Falk, Samuel Rea, Francis Lee Stuart, Melvin E. Stone, and J. G. White.

Electromagnetic Prospecting Hans Lundberg's Topic

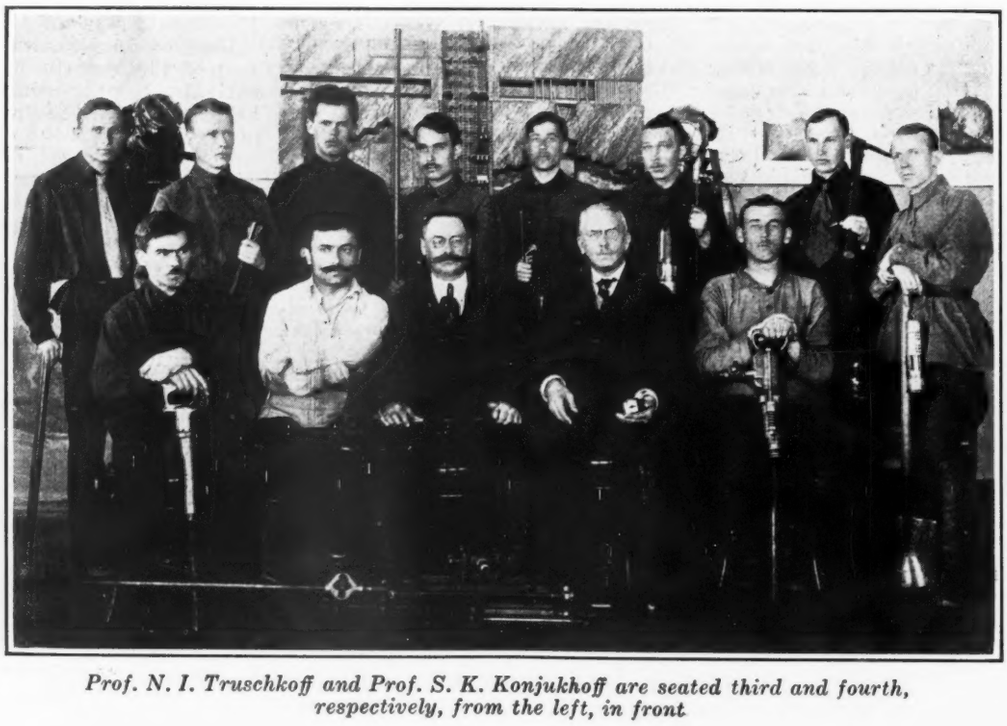
Hans Lundberg addressed the San Francisco Section of the A.I.M.E. at its meeting on June 9, 1925, on the subject of "The Application of Electromagnetic Apparatus in the Mining Industry." Mr. Lundberg presented the fnudamentals of the subject. He stated that the Swedish Geological Survey had developed electromagnetic appliances for the discovery of hidden ore deposits and had achieved marked success in their application. Two general methods are now sufficiently advanced in technique to be of practical value. One is the potential method and the other the electromagnetic method. In the first, two parallel electrodes are extended over the surface and contacts made with the earth at regular intervals. An alternating current is sent through the electrodes and the earth. Lines of equipotential are determined by the use of telephone receivers, and these are plotted upon a map. As an orebody is a better conductor than the inclosing rock, its presence is indicated by a concentration or drawing together of the equipotential lines.

The electromagnetic method is used where it is difficult to get good earth contacts. An insulated conductor is placed upon the ground inclosing the area to be examined. By the use of solenoids the field induced in the ground by the alternating current in the conductor is investigated. A body of good electrical conductivity below the surface will localize by induction its own electromagnetic field. The secondary fields are determined with respect to position and intensity and are plotted upon a map. The operations are simple. Two engineers assisted by five unskilled men can cover a square mile in a week where topographic conditions are favorable. The boundaries of an orebody can be determined.

Chemical Society Will Feature Petroleum Subjects

D· George A. Burrell, secretary of the Petroleum Division of the American Chemical Society has announced that the second yearly meeting of the American Chemical Society will be held this year at Los Angeles, Calif., in August, and that the spring meeting, April, 1926, will be held in Tulsa, Okla. Petroleum subjects will largely feature these meetings.

Ore-Mining Class, Tomsk Institute of Technology, Siberia



Prof. N. I. Truschkoff and Prof. S. K. Konjukhoff are seated third and fourth, respectively, from the left, in front

Men You Should Know About

N. Dickerman, mining engineer, of San Francisco, has just returned from a mine examination trip in southern Chile.

N. L. Stewart, of Salt Lake City, Utah, chief engineer Utah department, American Smelting & Refining Co., is making a short stay in West Virginia.

W. Parsons Todd, of New York, president of the Quincy Mining Co., has been visiting the various plants of the company in the Michigan copper district.

Raymond B. Ladoo has returned to New York after mine inspection work in Colorado. He has moved from the C. P. R. Building and has new offices at 441 Lexington Ave.

S. K. Dahl, consulting mechanical and milling engineer, of Los Angeles, Calif., is in Mexico on professional business. He expects to return to Los Angeles in the early part of July.

W. R. Wade has completed professional work in eastern Canada and, with Mrs. Wade, is motoring to the Coast, where they are likely to make their permanent home. His address will be 1230 Geary St., San Francisco.

W. A. Johnston, of the Canadian Geological Survey, who of recent years has been studying the placer gold deposits in the Cariboo district of British Columbia, has left for the Dease Lake district, to study the placer deposits there. **Forrest A. Kerr,** who also has gone to that district, will make a study of the rock formations.

Alfred L. Blomfield, mining engineer and metallurgist, was given a dinner on June 5 at the University Club in Denver on the occasion of his departure for Australia. Some years ago, while on a vacation in Australia, he purchased a big ranch which was then on the bargain counter after years of drought. The dinner was given by the engineers of Denver and Colorado Springs as a testimonial of the esteem in which he is held in those cities. About seventy attended. The chairman of the banquet committee was Carroll H. Wegemann, and speakers were S. A. Ionides, Robert Gardiner, L. S. Harner, A. J. Weinig, and M. F. Coolbaugh. George M. Taylor acted as toastmaster, and in his remarks brought out some of the high spots of Mr. Blomfield's work in the district. Among other things he pointed out that Mr. Blomfield is credited with saving the Cripple Creek district. Probably it was his insistence on his development program that led to the rejuvenation of the Cresson mine, under his management until recently. Certainly the fact of his operating the Golden Cycle mill without raising treatment charges was of critical importance. He came through the high-cost period with operating costs actually reduced, and recovery was higher. He made important contributions to the development of the Dorr tray thickener and the bowl classifier; in co-operation with Coe he devised the superthickener—these all of wide application, besides being important elements in the success of his own work. He realized after much trouble that the roasting of calcareous ores was hampered because the freely developed carbon dioxide prevented access of air. Limy ores having become prevalent, he found his leaching tanks "setting." To avoid this he reduced the temperatures to a point where the lime did not break down, although the tellurides were broken down, only to find that unconsumed coal from car bottoms and engine cinders in the ore were reprecipitating his gold. The low-temperature roast is now established; the coal consumption in roasting is at one-third the former figure, and cooling water is almost eliminated from the furnaces. In conjunction with these things was introduced screen-sizing of ore before roasting, each furnace handling one classification. Coming to Denver from Australia in 1907, he took over within a short time of its construction the Cycle mill, designed and built by Philip Argall, then the sole effective earnest advocate of cyanidation for the ores from the Cripple Creek district. **L. S. Harner,** formerly superintendent, succeeds Mr. Blomfield at the Cycle.

Alfred L. Blomfield

W. G. Norrie-Lowenthal has resigned as manager of the Porcupine Paymaster property in Ontario.

Arthur Notman has gone to northern Ontario, where he expects to visit Sudbury and some of the gold districts.

J. M. Callow, of the General Engineering Co., has gone to Salt Lake City. He will return to New York and sail for Europe in July.

Henry M. Ray, of Joplin, Mo., who has for many years been connected with zinc mining, has been visiting northern Ontario, where he has taken several options.

H. C. George, director of the school of petroleum engineering at the University of Oklahoma, will be engaged for the summer in scouting and geological exploration in Texas and southern Oklahoma for a group of Oklahoma oil men.

E. B. Swanson, who has served for several years as assistant to the director of the Bureau of Mines, has been appointed field manager of the government's Red River oil operations. Mr. Swanson's headquarters will be at Wichita Falls, Tex.

Obituary

Arthur L. Hawkesworth, of Butte, Mont., inventor of a detachable drill bit used in the Butte mines, described in *Mining Journal-Press* in the issue of Aug. 5, 1922, died on June 16 from a combination of gall bladder and kidney trouble. Mr. Hawkesworth was born fifty-five years ago in Bay City, Mich., and had lived in Montana thirty years.

N. Henry Emmons, 2d, of Framingham, Mass., died in Winnipeg, Canada, on May 25, as chronicled in these columns in the issue of June 6. His death came as a sad shock to his many sincere and devoted friends. He was born in St. Louis, Mo., May 12, 1870, and was graduated with the degree of engineer of mines from Washington University in St. Louis in 1893. Immediately after graduation he went to Mexico, where he was employed in various capacities for four years by M. Guggenheim & Sons. Later he became manager of the estates of Jose M. Botello at Parral, Chihuahua, and organized the Parral Milling Co., and constructed and operated its mill for treating ores from the Los Muertos and Veta Grande mines. From 1902 to 1905 he was consulting engineer for Hampson & Smith, of Mexico City, and formed, with Mr. Smith, the Taviche Mining & Milling Co., in Taviche, Oaxaca, and constructed and managed the mill for this company to treat the ore from the Poder de Dios mine. In 1905 he became mine surveyor and later engineer in charge of mine construction, water handling and prospecting at the Old Dominion Copper Co. at Globe, Ariz. In 1907 he became assistant manager, and later manager of the Tennessee Copper Co., at Copperhill, Tenn. As manager he helped construct the new sulphuric acid plant there. Next he was general superintendent of mines for the North Butte Mining Co., at Butte, Mont., where he directed the sinking of the new Granite Mountain shaft. In 1917 he became associated with the Air Nitrates Corporation, of New York and Muscle Shoals, first as engineer of production and materials and later as operation director. From 1919 to 1923 he was a consulting engineer, and in the fall of 1923 took charge of the plant of the Annapolis Lead Co., at Annapolis, Mo., as consulting engineer and active manager. In January, 1925, he became associated with the W A D Syndicate, of Boston, Mass., and Winnipeg, Man., as engineer in charge of its new property at Long Lake, Man. Here he was stricken with the attack of pneumonia that resulted in his death. It may be truly said that Mr. Emmons died in harness, as was his desire.

Recent Technical Publications

Reviews, Abstracts, and References

Illinois Limestone

Limestone Resources of Illinois. By Frank Kray and J. E. Lamar, Illinois State Geological Survey, Urbana. Bulletin 46, 1925.

Limestone is gaining wider recognition as one of the most essential and most extensively employed of all mineral products. Therefore a new bulletin of 392 pages giving detailed data on the limestone resources of Illinois is a welcome addition to the literature of this important subject. The main purpose is to describe the limestones in their application to road building, but as the stone may be used in various other ways one chapter is devoted to a brief description of other applications. The bulk of the volume, occupying 219 pages, with many maps and illustrations, comprises detailed descriptions of quarries and favorable rock exposures. Limestones of commercial importance are found in a northern district, and in a narrow strip along the western and southern edge, occupying about one-third of the state. Two parts of the report are welcome to all who in any way specialize in limestone or its products. These are the 17 pages giving results of physical tests, and the 23 pages of chemical analysis of both limestones and dolomites. As the uses of limestone are multiplying, and specifications are becoming more rigid, the physical and chemical properties of the rocks are of increasing significance. Therefore the report is valuable to anyone interested in limestone, either scientifically or commercially.

OLIVER BOWLES.

Metal Statistics

Year Book of the American Bureau of Metal Statistics. 1924. Published by the bureau, at 115 Broadway, New York City. Price $2.

This is the fifth issue of this valuable compilation of statistics relating to the production, consumption, imports and exports, prices and warehouse stocks of the principal non-ferrous metals. Names of the principal producers and the location of their plants are included, as in former editions, and a few new features appear to take the place of some of less value. A few minor errors are noticeable, but it is impossible to have such a book as this absolutely accurate in all particulars, as the editor well points out in his admirable explanatory text. About the only constructive suggestion that we can make is to have a more adhesive glue on the binding tape.

Slag and Gold. By Phil. H. Moore. Published by Thomas Allen, Toronto, Canada.

The heading at the top of this page has nothing to do with this book, for it is a novel, not a "technical publication." The scene changes from Goldfield, Nev., where the hero and villain got their start in life, to Porcupine, where most of the events in the story take place, with a few side shots at Toledo, Ohio, home of the financial interests concerned, and the heroine. It is a story of the early days of the Porcupine camp, and the author has evidently been on the scene of action, for the book contains considerable local color. Almost any mining man would, we think, find it an interesting story, though, in a literary way, we found it quite a come-down to read this right after finishing "The Constant Nymph." The book is more about gold than slag; unless the villain is supposed to play the part of slag. He is a very villainous villain, and the hero is most heroic, for those who like that sort of thing. An interesting and accurate picture of the first Porcupine fire, in 1911, takes up several pages, and dog lovers will like to hear about Juno and her pups.

Patents

Gold Separator—No. 1,540,543. June 2, 1925. H. T. Costa, Grants Pass, Ore. A pan of inverted frusto-conical shape adapted for settling heavy particles of gold out of a pulp.

Zinc Retort Cleaner—No. 1,540,636. June 2, 1925. Stevan Kovacevic, Pittsburgh, Pa. An arrangement of shovels and scrapers for cleaning out zinc retorts mechanically.

Mine Car Loading—No. 1,541,361. June 9, 1925. W. G. Knowles, Bessemer, Ala., assignor of one-half to A. T. Knowles, Bessemer, Ala. A scheme for mine car loading and haulage.

Zinc Oxide Recovery—No. 1,541,561. June 9, 1925. Oscar Gerlach, LaSalle, Ill. Siliceous material containing zinc is heated in the presence of oxygen, carbon, and sufficient lime to form a clinker having a fusion point above the vaporization point of zinc, to a temperature at which the clinker sinters. The zinc oxide fumes are collected, and the clinker cooled and ground.

Fume Precipitation—No. 1,541,677. June 9, 1925. Evald Anderson, Alhambra, Calif., assignor to International Precipitation Co., Los Angeles. Apparatus incidental to the Cottrell process of fume precipitation.

No. 1,541,678. June 9, 1925. W. J. L. Bauer, Frankfort-on-the-Main, Germany, assignor to the International Precipitation Co., Los Angeles. A collecting electrode for Cottrell equipment, made of a mixture of semi-conducting non-metallic material and carbon.

Mining Machine—No. 1,501,795. July 15, 1924. A. K. Mitchell, Bronxville, N. Y., assignor to St. Joseph Lead Co., New York City. An underground mining machine, now being manufactured by the Thew Shovel Co.

Crusher—No. 1,533,658. April 14, 1925. R. C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. No. 1,533,991. April 14, 1925. A. J. Jorgensen, Milwaukee, assignor to Allis-Chalmers Mfg. Co. Designs for gyratory crushers.

Reduction Furnace — No. 1,540,205. June 2, 1925. Arthur Jules Francois Joseph Cousin, Jemeppe-sur-Meuse, Belgium, assignor to Société Anonyme John Cockerill, Seraing, Belgium. A furnace for the direct reduction of metallic ores consisting of a movable hearth operated in a tunnel, one chamber of which is the combustion chamber where inclined burners play on the surface of the ore.

Nickel Smelting—No. 1,538,431. May 19, 1925. Sigurd Giertsen, Kristianssands Nickkelraffineringsverke, Kristianssands-S., Norway. In converting copper-nickel matte, blowing is continued after all iron is oxidized, heat being maintained by the addition of heat-producing material.

Dumping Pots—No. 1,538 499. May 19, 1925. C. P. Astrom, East Orange, N. J., assignor to M. H. Treadwell Co. Design for a motor-tilted slag or matte pot or ladle.

Cyanide Treatment—No. 1,539,120. May 26, 1925. H. W. Kaanta, El Paso, Texas, assignor to American Smelting & Refining Co., New York City. Precious metals are recovered from complex ores by mixing the ground ore with a cyanide solution of a strength sufficient to attack any film or coating on the precious-metal particles. A precipitant is thereafter added, and the whole agitated. The metal constituents of the ore, and the precipitant, are then concentrated.

Concentration

Concentrating Jig—No. 1,537,947. May 19, 1925. E. P. Humphrey, Upper Lehigh, Pa. Design for a hydraulic jig separator for coal or ore.

Concentrating Table—No. 1,541,095. June 9, 1925. J. B. Arthur, deceased, by Mary R. Arthur, executrix, Joplin, Mo. Design for a rotary concentrating table.

Petroleum Drilling

No. 1,539,236. May 26, 1925. M. S. Black, Huntington Park, Calif. A casinghead for oil wells.

No. 1,539,242. May 26, 1925. J. L. Carder, Los Angeles, assignor of one-third to J. A. Street, Los Angeles. An oil-well cleaner.

No. 1,540,195. June 2, 1925. H. C. Thrift, Houston, Tex. A well-packer plug.

No. 1,540,648. June 2, 1925. R. S. Pershing, Fort Worth, Tex. A heating device for oil wells.

No. 1,541,417. June 9, 1925. G. W. Keller, Coalinga, Calif. A fishing tool.

Rock Drilling

No. 1,540,167. June 2, 1925. K. O. Duncan, San Francisco, assignor to the Denver Rock Drill Mfg. Co., Denver. A screen for rock drills.

No. 1,540,187. June 2, 1925. P. H. Scheib and H. C. Gustafson, Denver, assignors to the Denver Rock Drill Mfg. Co., Denver. Design for a drill sharpener.

No. 1,540,191. June 2, 1925. A. H. Skaer and O. E. Clark, Denver, assignors to the Denver Rock Drill Mfg. Co. An apparatus for sharpening drill steel.

No. 1,540,910. June 9, 1925. W. A. Smith, Athens, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design for a hammer drill.

New Machinery and Inventions

An Ore-Dressing Microscope for Examining Molding Sand

The quality of a casting naturally depends upon the condition of the molding sand. While there are plenty of sand pits in which an entirely satisfactory grade of molding sand is deposited, many foundries, due to economic reasons, cannot avail themselves of this and are compelled to utilize the less satisfactory grade of sand found in pits in their vicinity. In many cases they resort to mixing sand of different quality and endeavor in this manner to create empirically a molding material of good quality.

Recently a number of papers have been published dwelling upon scientific methods of testing the molding sand in order to eliminate those less dependable means employed by the molder in selecting sand, which is more or less a matter of guesswork.

Binocular ore-dressing microscope, after Scheiderhoehn

The testing methods employed during recent years were based, aside from determining the fire-durability as well as the porosity and permeability of gases, upon chemical analysis. Total analysis, however, was of minor importance, and the principal point involved is to establish the ratio of quartz and clay present within the molding sand, which can be accomplished by a rational analysis. The two principal constituents of molding sand, of which quartz represents the body-substance and clay the agglutinant, are distinguished from each other through a definite size of grain and their quantitative relation. For the determination of these two factors several methods have been suggested from time to time.

The microscope, at relatively low power, renders a very satisfactory image of the distribution of the sharply outlined quartz grains in conjunction with the finely powdered clay. An instrument that is particularly suited for these examinations is the binocular ore-dressing microscope, after Schneiderhoehn, made by Ernest Leitz, Wetzlar, Germany. With the aid of this microscope the predominant grain sizes of new molding sand and sand already used, as well as of the intermediate products, can be determined quickly.

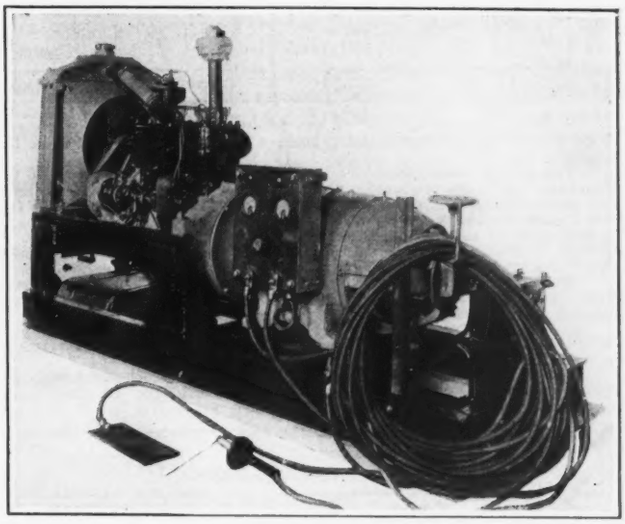
The circular glass plate, ruled in square centimeters, fitted within the metal stage of the microscope, facilitates the counting of the individual grains and the determination of their relative quantities. The size of the grains is measured by the aid of net-micrometers of varying values, corresponding to the mesh of sieves as are utilized in dressing. The micrometers referred to are inserted into the ocular tubes. Another advantage is that the microscope yields an image of highly stereoscopic character and that it permits prolonged use without the least eyestrain. The instrument is sold through E. Leitz, Inc., 60 East 10th St., New York.

Portable Welding Set Engine-Driven

A new engine-driven welding set has recently been added to the General Electric line of welding equipment. This outfit consists of a standard WD-12 welding generator driven by a Buda engine, all mounted on wooden skids to facilitate moving from place to place.

The engine is a Buda model WTU, especially designed for heavy duty. It is a four-cylinder, four-cycle machine of the "L" head type. with 3¾ in. bore and 5⅛-in. stroke. The S.A.E. rating is 22.5 hp., and at 1,400 r.p.m., the actual brake horsepower is 33.

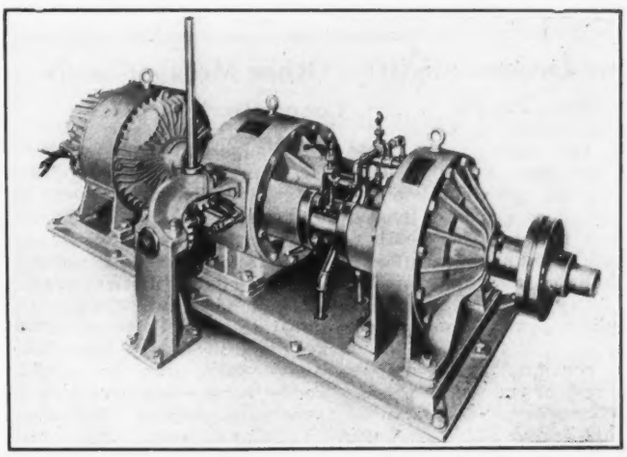
This gas-engine driven portable welding set is intended for use wherever electric power is not readily available.



The new outfit is being marketed complete with all accessories and ready for use. This unit should be of value in locomotive repair work at roundhouses, or in any industrial plant or on any construction job where electric power is not available.

A Novel Speed Reduction Unit

In a new speed reduction unit built by the American Engineering Co., of Philadelphia, a Hele-Shaw hydraulic pump and Hele-Shaw hydraulic motor are used as a speed reduction unit in place of the usual nest of gears. By utilizing hydraulic pressure, great power and silent, smooth operation are combined with extreme flexibility of control, according to the company.



A speed reducer that uses a hydraulic pump and a hydraulic motor instead of the usual nest of gears.

The Market Report

Daily Prices of Metals

June	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
18	13.50@13.625	55.125	56.125	8.30	7.90@8.00	6.95@6.975
19	13.55	55.125	56.125	8.25@8.30	7.90	6.975
20	13.475@13.50	55.25	56.25	8.25@8.30	7.90	6.975
22	13.45@13.50	55.25	56.25	8.25@8.30	7.90	6.95@6.975
23	13.45@13.50	55.375	56.50	8.20@8.30	7.875	6.975@7.00
24	13.375	55.375	56.50	8.20	7.85	6.975@7.00
Av.	13.488	55.250	56.292	8.263	7.896	6.975

*The prices correspond to the following quotations for copper delivered: June 18th, 13.75@13.875c.; 19th, 13.80c.; 20th, 13.725@13.75c.; 22d and 23d, 13.70@13.75c.; 24th, 13.625c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
18	60 3/8	61 3/8	64	253	254 3/4	33 5/8	33 1/16	34 1/8	33 9/16
19	60 1/2	61 3/8	64	252 3/4	254 3/8	33 1/4	32 3/4	34	33 7/16
22	60	61	63 5/8	251 7/8	253 7/8	33	32 1/2	33 15/16	33 7/16
23	59 7/8	60 7/8	63 5/8	252 1/4	254 3/8	33 3/8	32 3/4	34 1/4	33 1/2
24	60	60 7/8	63 5/8	252 3/4	254 5/8	33 1/2	32 3/4	34 1/8	33 1/2

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold London	June	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
18	4.85 1/2	68 3/4	31 11/16	84s 11 1/2d	22	4.85 5/8	69 3/8	32	84s 11 1/2d
19	4.85 1/2	68 3/4	31 11/16	84s 11 1/2d	23	4.85 5/8	70	32 7/16	84s 11 1/2d
20	4.85 5/8	68 7/8	31 13/16	....	24	4.85 5/8	70	32 7/16	84s 11 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Copper and Lead Decline Slightly; Other Metals Steady

New York, June 24, 1925—The buying movement in copper subsided as suddenly as it started, and since last Thursday the market has been quiet, with prices receding to the previous level. Lead has been in moderate demand at somewhat lower prices. Zinc and tin still hover around 7c. and 56c. respectively, tin being in better demand. Silver yesterday and today has ruled at 70c. per oz., the highest price since Nov. 1, 1924.

Business conditions continue good and the outlook for the rest of the year is favorable. Metal consumers are not buying far ahead, but are active.

Copper Back to 13 5/8c.

Late last Wednesday most producers raised their copper quotations to 13⅞c. delivered, and on Thursday a fairly good tonnage was sold at this price, both for Connecticut and up-state delivery. Some metal was still offered for 13¾c., however, and this was readily sold. Since Friday, however, the bottom seems to have dropped out of the market, and producers have been able to make sales only by cutting prices. Today, copper has been sold by two or three producers at 13⅝c., Connecticut Valley delivery, for July, though several others are asking nominally 13¾c. The export market has been the quietest for a long time, and it is no doubt the absence of foreign orders that has caused some sellers to throw the metal on the market here. It is rumored that copper held by Stinnes interests in Germany is being liquidated; at any rate, two German firms are offering the metal below the American market and have killed the business for the time being so far as American producers' agencies are concerned. Today, the best bid for June copper is 13.45c., f.a.s., with 13.50@13.55c. bid forward. Most producers in the United States are well sold up and are unlikely to press copper on an unwilling market, but unless foreign demand picks up, custom smelters are likely to be more active in the domestic market than they have for some time. Most of the inquiries have been for prompt or July shipment. Consumers continue loath to buy much ahead.

Total domestic sales for the week ending today are less than half those of the week before, but still were well above those in the preceding dull period.

Lead Quiet at Reduced Prices

The American Smelting & Refining Co.'s contract price for New York lead was reduced from 8.40c. to 8.30c. on Thursday, June 18. Today, June 24, a further reduction to 8.20c. was made. The demand for lead continues to be modest compared with what it was two or three weeks ago, but is far from non-existent, as consumers are buying only for their immediate requirements and cannot stay out of the market for long. Lead has been available for several days at 8¼c., New York, owing to the possibility of buying it in the West and shipping it East on that basis. Some business has also been done as low as 8.20c. for New York and nearby points in the last three days. The principal producer in Missouri continues to quote 8c., which has been above the level at which others have been willing to sell. Average price business, however, has prevented the accumulation of stocks so far. Yesterday and today, 7.85c., St. Louis, has been quoted without arousing much response. Desilverized is scarcer than chemical lead in the Middle West, especially corroding grades, which have sold as high as 8.15c., Chicago. Common lead has brought 8c., Chicago.

World lead production for May was at a slightly lower rate than in April, according to figures just published by the American Bureau of Metal Statistics, though United States production averaged about a car a day more than in April. The May total was 48,661 tons.

Zinc Still Around 7c.

The zinc market is as quiet as ever, with the domestic prices governed by what can be obtained for the metal

abroad. A fairly good export inquiry was in evidence yesterday, perhaps occasioned by a reported strike in Antwerp, but the foreign market is not particularly active today. Prices have been at 7c. or slightly less all week, with moderate tonnages sold for prompt and July delivery. High-grade continues at 8½@8¾c., delivered.

Demand for Tin Improves

Tin was in good demand for both spot and forward delivery in the last three days, with consumers showing more interest than for some time. Spot is very scarce, and has commanded a premium of about ⅝c. over forward. Prices have ruled slightly above 56c. all week.

Silver Highest for the Year

Silver has had a spectacular rise during the past week, culminating in a price of 70c., which exceeds the previous high for the year by ⅝c. The first step in this advance occurred on June 22, although the New York market on the 20th gave no intimation of this strength. In fact, offerings of silver in New York on that day at current rates were not readily absorbed, and conditions were generally quiet. On the 22d, however, London advanced 1/16d., and before the market closed in New York, business was done at ½c. above the London net parity. By jumping the quotation another 1/16d., London brought its price on June 23d to a parity with the rates prevailing in New York on that day, and this level has since been maintained both locally and abroad.

The uncertainty of the situation in China, with consequent heavy buying from that quarter, caused the advance, and the market appears steady at the higher level.

Mexican Dollars: June 18th and 19th, 52⅞c.; 20th, 53c.; 22d, 53⅜c.; 23d and 24th, 53¾c.

Foreign Exchanges Irregular

Foreign exchanges have been irregular, especially francs and lire. Closing cable quotations on Tuesday, June 23, were as follows: Francs, 4.685c.; lire, 3.7175c.; and marks, 23.81c. Canadian dollars, par.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £118.

Antimony—

Chinese brands, spot, 16½c. per lb.

Cookson's "C" grade, 20¾c.

Chinese needle, lump, nominal, 13@14c.

Standard powdered needle, 200 mesh, nominal, 16@17c.

White oxide, Chinese, 99 per cent Sb_2O_3, 16@18c.

Bismuth—$2 per lb., in ton lots. London, 7s. 6d.

Cadmium—60c. per lb.

Iridium—$375@$400 per oz. London £70.

Nickel—Ingot, 34c.; shot, 35c.; electrolytic, 38c.; London, £170@£175 per long ton.

Palladium—$79@$83 per oz. Crude, $60. London £16.

Platinum—$120 per oz. refined. London, £25 per oz. Market quiet and it is difficult to get full prices.

Crude, $115.

Quicksilver—$83@$84 per 75-lb. flask. San Francisco wires $82.83. Firm. London £14¼.

Tungsten—Metal powder, $1.16 per lb. contained tungsten.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium and **Zirconium** are unchanged from the prices given in the June 6 issue.

Metallic Ores

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite $11.50@$11.75 per unit. Ordinary quality, $11@$11.25. Scarce.

High-grade Western scheelite, $11.50@$12.

Chrome, Galena Radio Crystals, Iron Ore, Manganese, Molybdenum, Tantalum, and Vanadium Ores are unchanged from June 6 quotations.

Zinc Firm—Lead Ore Lower

Joplin, Mo., June 20, 1925

Zinc Blende	Per Ton
High	$54.15
Premium, basis 60 per cent zinc	$51.00@$52.00
Prime Western, 60 per cent zinc	$49.00
Fines and slimes	$48.00@$45.00
Average settling price, all	$51.18
Lead Ore	
High	$113.90
Basis 80 per cent lead	$107.50
Average settling price, all	$110.02

Shipments for the week: Blende, 17,036; lead, 2,599 tons. Value, all ores the week, $1,157,930.

While a slight tonnage of Prime Western grades of blende sold last week on a basis of $48.50, no report of less than $49 is made this week. Otherwise prices are unchanged.

The closing price of lead ore is given at $107.50 per ton, while sellers claim that as high as $115 was paid early in the week.

Purchases have been exceeding shipments until approximately one-half the bin stock is sold.

Platteville, Wis., June 20, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$51.00
Lead Ore	
Lead, basis 80 per cent lead	$110.00

Shipments for the week: Blende, 794 tons; lead, none. Shipments for the year: Blende, 22,158; lead 942 tons. Shipments for the week to separating plants: 1,220 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from June 6 prices.

Mineral Products

Arsenious Oxide (White arsenic)—4½@4¾c. per lb. Some producers are holding at 5c. but are unable to sell at that level.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from June 6 prices.

Ferro-Alloys

Ferrotungsten — $1.05 per lb. contained tungsten.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrouranium and **Ferrovanadium** are unchanged from the prices given in the June 6 issue.

Metal Products

Copper Sheets—Base price 21.75c. Wire, 15½c.

Zinc Sheets—10½c. per lb.

Nickel Silver, Yellow Metal and **Lead Sheets** are unchanged from the issue of June 6.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and Zirkite are unchanged from June 6 prices.

Steel Prices Irregular

Pittsburgh, June 23, 1925

A noteworthy incident is the curtailing of rail deliveries by a number of roads, representing postponement of unknown duration, while there has been light buying of freight cars for months past. In this respect the steel outlook becomes less promising. In other respects it proves better at this date than was expected. Mill operations have only lately passed below 70 per cent, while before this time last year they had gone below 50 per cent. Some mills report heavier bookings thus far in June than in the same period of May, but that month was the lightest in sales since July, 1924.

In most steel lines prices are irregular, with competition keen, but there has been no important decline since that in plates three weeks ago. Reports from all consuming lines are relatively favorable, no important decreases in operations having occurred or being definitely in prospect. Fabricated steel contracts let have run higher in the past thirty days than the average of the preceding portion of the year.

Pig Iron—Foundry pig iron at Valley furnaces is up 50c., representing recovery of the loss sustained recently when a single buyer bought a large tonnage for second half. Steel-making iron remains dull. Bessemer, $19; basic, $18; foundry, $18.50, f.o.b. Valley furnaces.

Connellsville Coke—The Connellsville market remains at $3 quoted on contract, spot being easier at $2.75@$2.85. Spot foundry remains easy at $3.75@$4.25.

Company Reports

St. John del Rey Mining Co., Ltd.

Gold; Brazil

Report for the year ended Feb. 28, 1925, of the St. John del Rey Mining Co. shows the following:

Gold, produced, at par value	£388,904	
Silver	3,314	
	£392,218	
Premium realized on sale of gold	28,976	
	421,194	
Less government duties and transport charges	15,944	
		£405,250
Working cost in Brazil	285,881	
Developments in the mine	11,364	
London expenses, including directors' percentage	12,092	
		309,337
		95,913
Amount brought forward from last account		41,493
		137,406
Interim dividends on the preference and ordinary shares, paid Dec. 12, 1924	26,937	
Proposed final dividends on preference and ordinary shares, payable June 26, 1925	40,593	
Balance of income tax and corporation profits tax	9,480	
		77,010
		60,396
Transferred to capital works account	20,000	
Balance carried forward	40,396	
		£60,396

Operations were seriously restricted throughout the year by inability to obtain an adequate force of miners. This was due to the demand for labor at the coffee plantations and elsewhere, which withdrew men from the company's service and drained the usual sources of supply. As the result of the shortage of labor, the tonnage crushed was the lowest recorded in any year since 1900, and amounted to only 140,200 tons.

Balance Sheet, Feb. 28, 1925

Liabilities

	£	s.	d.	£	s.	d.
To share capital account, viz.:						
Issued:						
546,265 ordinary shares, £1 each, fully paid	546,265	0	0			
100,000 10 per cent preference shares, £1 each, fully paid	100,000	0	0			
				646,265	0	0
Amounts taken out of profits since March 1, 1901, for capital works and redemption of bonds, as per last account	952,282	11	6			
Add amount transferred from profit and loss account	20,000	0	0			
And from guarantee fund at Feb. 28, 1925	5,000	0	0			
				977,282	11	6
				1,623,547	11	6
Bills payable				38,000	0	0
Sundry credit balances				124,953	15	3
Reserve fund				140,000	0	0
Guarantee fund				15,326	4	9
Profit and loss account				80,989	6	2
				£2,022,816	17	8

Assets

	£	s.	d.	£	s.	d.
By capital expenditure, viz.:						
Morro Velho and Cuiabá mines, lands, and buildings, as per last account	248,907	15	9			
Add expenditure during the year	6,109	16	0			
				255,017	11	9
Surface works, plant and machinery, as per last account	939,870	15	8			
Add expenditure during the year	22,862	14	2			
	962,733	9	10			
Less tramways, sinking and renewal funds	25,470	16	5			
				937,262	13	5
Shafts and tunnels, as per last account	271,755	10	1			
Add expenditure during the year	12,794	13	1			
				284,550	3	2
Stores, materials and plant in stock at Morro Velho and in transit				208,905	4	9
				1,685,735	13	1
Sundry debtors and debit balances				26,836	6	6
Stock of gold and silver in Brazil				82,073	2	7
Cash on deposit				55,640	1	8
Investments—stocks and bonds				172,531	13	10
				£2,022,816	17	8

Amparo Mining Co.

Gold, Silver; Mexico

The report for the year 1924 shows that 122,833 metric tons were mined and milled, as against 150,629 metric tons for 1923 and 157,465 metric tons for 1922. Operating costs showed a slight reduction, being $6.65 per ton, compared with $6.74 for 1923. The work of equipment of the Mazata mine was finished and the mill commenced grinding in December, 1924. There is no doubt that the end of the Amparo Mining Co.'s mine is clearly in sight, since in spite of vigorous exploration work, no new orebodies containing a large tonnage have been discovered. The assured ore promises about six months' operations.

Production and Earnings

Gold and silver bars		$1,113,719.76
Concentrates		101,242.69
		$1,214,962.45
Operating costs as per cost sheet		816,365.90
Gross profit		$398,596.55
Various credits		47,636.78
		$446,233.33
Depreciation	$36,219.90	
Damages and losses	2,192.84	
Sundries	225,266.43	
		263,679.17
Net profit		$182,554.16

Dividends totaling $200,000 were paid during the year.

June Mining Dividends Show Slight Increase

The following dividends were paid during June by mining and metallurgical companies operating in the Americas:

Companies in the United States	Situation	Per Share	Total
American Metal	U. S. and Mex.	$0.75 Q	$443,657
American Metal pfd	U. S. and Mex.	1.75 Q	87,500
American Smelting & Refining pfd	U. S. and Mex.	1.75 Q	875,000
Bingham Mines, s,l	Utah	0.50 Q	32,500
Calumet & Arizona, c	Ariz.	1.00 QX	642,532
Eagle Picher Lead, l,z	U. S.	0.40 Q	400,000
Federal Mining & Smelting pfd. s,l,z	Idaho and Okla.	1.75 Q	210,000
Hecla Mining s,l	Idaho	0.50 Q	500,000
Homestake Mining, g	S. D.	0.50 M	125,580
Inland Steel	Minn.	0.625 Q	629,379
Mohawk Mining, c	Mich.	1.00 Q	115,000
Mother Lode Coalition, c	Alaska	0.375 SA	937,500
National Lead	U. S.	2.00 Q	413,108
National Lead pfd	U. S.	1.75 Q	426,433
St. Joseph Lead	Mo.	0.50 Q	968,033
Sloss-Sheffield Steel & Iron	Ala.	1.50 Q	150,000
Texas Gulf Sulphur	Texas	2.25 QX	1,428,750
Tintic Standard, s,l,c	Utah	0.40 Q	459,766
U. S. Steel	U. S.	1.75 Q	8,895,294
United Verde Copper	Ariz.	2.00 Q	600,000
Utah Copper	Utah	1.00 Q	1,624,490
Companies in other countries			
Chile Copper	Chile	0.625 Q	2,375,000
Hollinger Consolidated Gold	Ont.	0.08 4 wks.	393,600
Lake Shore, g	Ont.	0.10 QB	200,000
McIntyre-Porcupine, g	Ont.	0.25 Q	199,500
Mexico Mines of El Oro, g,s	Mexico	2s.	£21,000
St. John del Rey, g	Brazil	1s. 3d.	34,141
St. John del Rey pfd., g	Brazil	1s.	,000
San Francisco Mines, l,z,c	Chihuahua	1s. 6d.	112,797
Total			$23,132,622

Q, quarterly; X, includes 50c. extra; M, monthly; SA, semi-annually; B, includes bonus of 5c.; s, silver; l, lead; c, copper; z, zinc; g, gold.

Dividend disbursements in June were not far different from those paid in March for the previous corresponding quarter, the total being about $600,000 greater than in that month. Calumet & Arizona doubled its usual dividend, the extra 50c. being designated as from reserves for depreciation and depletion. The 50c. extra dividend paid by Texas Gulf Sulphur was taken out of the reserve for depletion. Hollinger begins this month paying 8c. a share every four weeks instead of 5c., thereby increasing the rate of yearly distribution to stockholders to $5,116,800. St. Joseph Lead increased its dividend by $193,343 a quarter by declaring a 25 per cent stock dividend, outstanding shares now amounting to 1,936,066.

A few irregular dividend payers that appeared in the March list are absent in June, but no regular passed its dividend or even reduced it.

Current Prices of Mine Materials and Supplies

Rise and Fall of the Market

One or two items, such as manila rope and zinc dust, show firmness compared with a month ago. The most important changes, and these in a downward direction, occurred during the past month, in steel sheets, track bolts, steel plates, tile, lumber, wire nails, linseed and other oils. The price trend in mine materials and supplies, though downward, is gradual.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.30@2.40	$3.90	$3.50	$4.20	$3.89
Black					
No. 28	3.15@3.30	4.80	4.00	5.25	4.35
Galvanized					
No. 28	4.25@4.35	5.80	5.00	6.25	5.35

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh			
	Current	One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Current	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, 9/16-in. and larger	$2.80	$2.90@3.00	$3.55	$3.65	$4.35	$2.90
Track bolts	3.90@4.00	3.75@4.00	4.55	4.55	5.85	3.90
Standard section angle bars	2.80	2.75	3.30	3.40	4.00	3.85

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90@2.10	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channel, 3 to 15 in.	1.90@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 6 in., ¼ in. thick	1.90@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.90@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Plates	1.90@2.00	2.00	3.34	4.15	3.25	3.10	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD	1 to 3	62	50½	1 to 1½	30	13
LAP WELD	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
3½ to 6 in. lap welded	48%	56½%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York					
	Current	One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$50.60–51.60	$61.60–63.60	$40.00 base	$46.70–48.20	$47.60	$52.00

NUTS—Semi-finished, ½x½-in., 2c. each. Discount 70% for 9/16-in and smaller; 65% for ¾-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York						
	Current on Trucks	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1162	$0.1162	$0.06	$0.1325	$0.078	$0.108	
6x12x12	.1743	.1743	.0825	...	.102	.156	$0.252*
8x12x12	.2179	.2179	.1125	.25	.14	.244	.312†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York		St. Louis	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$45.00	$46.00	$39.00	$41.00
3x10 to 10x10	49.00	50.00	43.00	45.00
3x12 to 12x12	54.00	55.00	48.00	50.00

Other Cities	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	Pine	Fir*	Hemlock	Spruce	Pine	Fir*
Boston	$51.00	$48.00†	$50.00	$50.00	$61.00	$58.00†
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Denver	.....	35.75	35.75	35.75	...	36.25
Minneapolis	43.00	39.75	36.00	.....	44.50	39.75
Kansas City	41.00	40.75	.....	.....	52.00	41.75
Birmingham	32.00	.....	.....	.....	34.00	.....

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.75	$3.25	$3.85	$4.28	$3.33	$4.95
Cut	2.90	....	5.25	5.00	3.58	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.39

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel 280-lb. net	
	Finishing	Common	Finishing	Common
New York	$18.20	$12.@13.10	$3.50	$2.50@$2.75
San Francisco	.....	22.00	....	(180-lb. net) 1.60

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrel (5 bbl. lots)	$1.07	$0.98	$1.23	$0.94

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Current	1 Yr. Ago	Current	1 Yr. Ago
Red	15.75	15.00	17.25	16.50
White	15.75	15.00	15.75	15.00

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket ..... 56c per ft.

Air—Best Grade
¾-in., per ft. ..... 3 ply $0.33 4 ply $0.40

Steam—Discounts from List
First grade ..... 40% Second grade ..... 40–5% Third grade ... 40–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.
Best grade ..... 50–5% Second grade 50–10–5%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	30–10%
Heavy	20–5%

RAWHIDE LACING—For cut, best grade, 45–5%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45–5%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¼ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¼-in. and larger, 1,200-ft. coils.

Atlanta	$0.30	New Orleans	$0.26½
New York	.27	Seattle	.17
Chicago	.21½	San Francisco	.26

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	.1625	.1925

FLOTATION OIL—

Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal.	$0.30

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b Palmerton, Pa., per lb.	$0.09
Litharge, f.o.b. New York kegs, per 100 lb	15.75
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	.18@.22

Mining Stocks—Week Ended June 20, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	38⅞	37⅞	39⅛	Ap.16, My.23, 0.75
Arcadian Consol.	Boston	1⅛	1⅛	1⅛	
Ariz. Com'l.	Boston	11⅛	10⅛	11	Ja.19, Ja 31 SA 0.50
Calaveras	N. Y. Curb	...	...	2	
Calumet & Arizona	New York	49⅛	47⅛	48⅛	Jn.15, Jn.22 Q 0.50
Calumet & Hecla	Boston	14⅛	12⅞	13⅞	Ja.30, Mh.4 [0.50
Canario Copper	N. Y. Curb	5⅛	5⅛	5⅛	
Cerro de Pasco	New York	53	50⅛	52	Ap.23 My.1, Q 1.00
Chile Copper	New York	34⅛	33⅛	33⅛	Jn.3, Jn.29, Q 0.62½
Chino	New York	21⅛	20⅞	21⅛	Sept., 1920 0.37½
Con. Coppermines	N. Y. Curb	2⅞	2⅛	2⅞	
Copper Range	Boston	22⅛	20⅞	22	Ap.9, My.4 1.00
Crystal Copper	Boston Curb	*51	*51	*51	
East Butte	Boston	3⅛	3	3⅛	Dec., 1919 0.50
First National	Boston Curb	*20	*18	*18	Feb., 1919 0.15
Franklin	Boston	1	*75	1	
Granby Consol.	New York	15⅞	14⅛	15⅜	May, 1919 1.25
Greene-Cananea	New York	13⅛	12⅞	13⅛	Nov., 1920 0.50
Hancock	Boston	*60	*50	*60	
HoweSound,new,r.t.c.	N. Y. Curb	...	...	16⅛	April, 1924 0.05
Inspiration Consl.	New York	27⅛	25⅞	26⅞	Jn.18, Jy.6, Q 0.50
Iron Cap	Boston Curb	1⅝	1⅝	1⅝	May, 1923 0.15
Isle Royale	Boston	13	11⅛	12⅜	Sept., 1923 0.50
Jerome Verde Dev.	N. Y. Curb	1⅛	1⅛	1⅛	
Kennecott	New York	52	50	51⅛	Jn.5, Jy.1, Q 0.75
Lake Copper	Boston	1⅜	1⅛	1⅛	Jn.1, Jn 15 Q 0.50
Magma Copper	NewYork	42⅛	39⅞	41⅞	Jn. 15, Jy. 15, 0.75
Mason Valley	N. Y. Curb	1⅜	1⅜	1⅜	
Mass Consolidated	Boston	*40	*40	*40	Nov., 1917 1.00
Miami Copper	New York	9⅛	8⅞	9⅛	My.1 My.15 Q 0.25
Mohawk	Boston	30⅛	28⅛	30⅛	My. 2, Jn. 2 1.00
Mother Lode Con.	New York	7	6⅞	7	Jn. 12, Jn. 30 0.37½
Nevada Consol.	New York	12⅞	12⅛	12⅜	Sept., 1920 0.25
New Cornelia	Boston	19⅜	19⅛	19⅛	My. 8, My. 25Q 0.25
North Butte	Boston	1	*95	1	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	*88	*83	*88	No.14, De.2 0.05
Old Dominion	Boston	20	19⅛	20	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†102	†98	...	Jn 20, Jy.2 Q 1.00
Quincy	Boston	25	22	24	Mar., 1920 1.00
Ray Consolidated	New York	13⅛	12⅛	12⅜	Dec., 1920 0.25
Ray Hercules	N. Y. Curb	...	...	14	
St. Mary's Min. Ld.	Boston	35	33	35	Ap. 20, My.20, 3.00
Shannon	Boston	*60	*55	*60	Nov., 1917 0.25
Shattuck Arizona	New York	6⅛	6⅛	6⅛	Jan., 1920 0.25
Superior & Boston	Boston	1⅛	1	1⅛	
Tenn. C. & C.	New York	11⅞	10⅛	11⅛	De.31, Ja.15,Q 0.25
United Verde Ex.	N. Y. Curb	24⅞	24	24	Jy. 6, Aug. 1 0.50
Utah Copper	New York	90⅛	89⅛	90⅛	Mh.20,Mh.31,Q 1.00
Utah Metal & T.	Boston	*48	*46	*46	Dec., 1917 0.30
Victoria	Boston			*40	
Walker Mining	Salt Lake	2.60	2.50	2.50	
NICKEL-COPPER					
Internat. Nickel	New York	31	29	29⅛	March, 1919 0.50
Internat. Nickel pfd.	New York	99⅛	99⅛	99⅛	Ap.16, My.1, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	7⅛	7⅛	7⅛	
Gladstone M. M. Co.	Spokane	*25	*25	*25	Ap. 1925 0.00⅛
National Lead	New York	148⅛	145	145	Jn.12, Jn.30, Q 2.00
National Lead pfd.	New York	...	...	117	My.22, Jn.15 Q 1.75
St. Joseph Lead	New York	49⅛	47	48⅞	Jn. 9, Jn. 22 0.50
ZINC					
Am. Z. L. & S.	New York	9⅛	7	8⅛	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	30⅛	27	29⅛	Nov., 1920 1.50
Butte C. & Z.	New York	5⅞	5⅛	5⅛	De.10, De.24 0.50
Butte & Superior	New York	13⅛	12	12⅜	Mh.19, Mh.31 0.50
Callahan Zn-Ld.	New York	3	2⅛	2⅛	Dec., 1920 0.50
New Jersey Zn.	N. Y. Curb	186⅞	185	185¼	Jn.20,Jy.10 Ex. 2.00
United Zinc	N. Y. Curb	...	...	*35	
Yellow Pine	Los Angeles	*67⅛	*64	*67	De.10,De.15 Q 0.04
GOLD					
Alaska Juneau	New York	1⅞	1⅞	1⅞	
Argonaut	Toronto	*28½	*27½	*28½	
Barry-Hollinger	Toronto	*49⅛	*47	*49	
Carson Hill	Boston	...	...	*25	
Consol. W. Dome L.	Toronto	*14⅛	*13⅛	*13⅜	
Cresson Consol. G.	N. Y. Curb	3⅛	3⅛	3⅛	Mh.31, Ap.10 Q 0.10
Crown Reserve	Toronto	*34	*28⅛	*30	Jan. 1917 0.05
Dome Mines	New York	14⅛	14	14⅛	Mh.31,Ap.20,Q 0.50
Golden Cycle	Colo. Springs	1.43	1.42	1.42	Dec.11, 1924 0.03
Hollinger Consol.	Toronto	14.85	14.70	14.80	Jn. 1, Jn. 17, 0.08
Homestake Mining	New York	44⅛	44	44	Jn.20, Jn.25 M 0.50
Kirkland Lake	Toronto	*38½	*36	*38⅛	
Lake Shore	Toronto	5.76	5.70	5.75	Mh.2, Mh.16, 0.05
McIntyre-Porcupine	New York	17⅛	17⅛	17⅛	My.1, Jn.1, 0.25
Newray	Toronto	*20	*19	*19⅛	
Night Hawk Pen.	Toronto	*24⅛	*24⅛	*24⅛	
Portland	Colo. Springs	...	...	*40	Oct., 1920 0.01
Rand Mines	New York			36⅛	Fe.17, Fe.25 1.79
Teck-Hughes	Toronto	1.40	1.39	1.39	
Tom Reed	Los Angeles	*43	*30	*35	Dec., 1919 0.02
Tough-Oakes	Toronto	*37	*33	*35	
United Eastern	N. Y. Curb	*48	*48	*48	July, 1924 0.05
Vipond Cons.	Toronto	1.08	1.06	1.07	
Wright-Hargreaves	Toronto	4.38	4.30	4.35	Jn.15, Jy.1 5.00
GOLD AND SILVER					
Black Oak	N. Y. Curb	...	...	*81	
Con. Cortez	N. Y. Curb	...	...	*9	
Con. Virginia	San Francisco	*5⅛	*4	*4	
Continental Mines	N. Y. Curb			1⅛	
Dolores Esperanza	N. Y. Curb	*50	*50	*50	July, 1923 0.05
Premier Gold	N. Y. Curb	2 7/16	2⅛	2 7/16	Jn.18, Jy.1, 0.08
Tonopah Belmont	N. Y. Curb	*57	*52	*57	Mh.15, Ap.1 0.05
Tonopah Divide	N. Y. Curb	...	...	*23	Oct., 1923 0.10
Tonopah Extension	N. Y. Curb	1⅛	1⅛	1⅛	Mh.11, Ap.1, Q 0.05
Tonopah Mining	N. Y. Curb	3⅛	3⅛	3⅛	Mh.31, Ap.21, 0.07½
Unity Gold	N. Y. Curb	*90	*80	*90	
West End Consol.	N. Y. Curb	...	...	*25	Mar., 1923 0.05
Yukon Gold	N. Y. Curb	...	...	*35	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.
SILVER					
Alvarado	Boston Curb	...	...	*50	Oct. 1920 0.50
Beaver Consol.	Toronto	*29	*27	*28½	May, 1920 0.03
Castle-Trethewey	Toronto	*83	*82	*82½	
Coniagas	Toronto	1.75	1.60	1.60	May, 1924 0.12½
Keeley	Toronto	1.85	1.82	1.83	Mh.1, Mh.15SA 0.12
Kerr Lake	N. Y. Curb	1⅛	1	1	Ap.1, Ap.15, Q 0.12½
La Rose	Toronto	*49	*49	*48½	Apr., 1922 0.10½
Lorrain Trout Lake	Toronto	1.07	1.05	1.06	Jy. 2, Jy.15 0.05
McKinley-Dar.-Sav.	Toronto	*28½	*27	*28½	Oct., 1920 0.03
Mining Corp. Can.	Toronto	2.76	2.71	2.75	Sept., 1919 0.12½
Nipissing	N. Y. Curb	4⅞	4⅛	4⅞	Jn.30, Jy.20, Q 0.15
Ontario Silver	New York	...	...	7⅛	Jan., 1919 0.50
Temiskaming	Toronto	*18	*17	*17	Jan., 1920 0.40
SILVER-LEAD					
Ahumada	New York	11⅛	10⅛	10⅜	Jn.15, Jy.2, Q 0.07½
Bingham Mines	Boston	31⅛	30⅞	31	Jn.20, Jn.30 Q 0.50
Cardiff M. & M.	Salt Lake	1.40	1.35	1.35	De.16, No.18 0.10
Chief Consol.	Salt Lake	3.87½	3.87½	3.87½	Ap 10, My. 1 0.10
Columbus Rexall	Salt Lake	*11⅛	*9⅛	*10	Aug., 1923 0.05
Eruption	Boston Curb	3	2⅞	2⅛	Jn.15, Jy.2, Q 0.07½
Federal M. & S.	New York	18⅛	16⅜	18⅛	Fe.26, Mh.15 Q 1.75
Federal M. & S. pfd.	New York	57	54	55⅛	My.25, Jn.15,Q 1.75
Hecla Mining	N. Y. Curb	14	13⅛	13⅞	Jn.15, Jy.1 Q 0.75
Iron Blossom Con.	Salt Lake	...	...	*39	Oc.25, 1924 0.01½
Iron King Mining	Salt Lake	*69	*54	*55	
Keystone Mining	Salt Lake	*86	*85	*85	
Mammoth Mining	Salt Lake	2.40	2.37½	2.37½	My.15 My.25 0.10
Marsh Mines	N. Y. Curb			*4	June, 1921 0.02½
Park City	Salt Lake	5.70	5.30	5.50	Jn.15, Jy.1 Q 0.15
Park Utah	Salt Lake	5.65	5.30	5.50	April. 1924 0.15
Prince Consol.	Salt Lake	*40	*35	*39½	
Silver King Coal	Salt Lake	8.00	7.95	8.00	Jn.20, Jy 1, Q 0.25
Silversmith	Spokane	*20	*17½	*19½	Ap.1, Ap.10 0.01
Tamarack-Custer	Spokane	*58	*50	*56	Sept, 1924 0.25
Tintic Standard	Salt Lake	11.00	10.25	11.00	Jn.23, Jy.15 Q 0.40
Utah-Apex	Boston	6⅛	5⅛	6⅛	Jy.3, Jy.15, Q 0.35
Western Utah Copper	N. Y. Curb	...	...	*18	
IRON					
Bethlehem Steel	New York	39⅜	38⅛	38⅛	July, 1924 1.25
Char. Iron	Detroit	...	...	*20	
Char. Iron pfd.	Detroit	...	...	*85	
Colorado Fuel & Iron	New York	43⅛	37⅛	41⅛	May, 1921 0.75
Gt. North'n Iron Ore	New York	28⅛	27⅞	27⅞	Ap.11, Ap.30 1.00
Inland Steel	New York	40⅛	39⅛	40	My.15, Jn.1 0.62½
Mesabi Iron	N. Y. Curb	2⅛	2⅛	2⅛	
Replogle Steel	New York	14⅛	13⅛	13⅛	
Republic I. & S.	New York	46⅛	44⅛	44⅜	May, 1921 1.50
Republic I. & S. pfd.	New York			86⅛	Jn.17, Jy.1, Q 1.75
Sloss-Sheffield S. & I.	New York	87⅛	84⅛	85⅛	Jn.10, Jn.20 Q 1.50
Sloss-Shef. S.&I. pfd.	New York	93⅛	93	93	Jn.20, Jy.1, Q 1.75
U. S. Steel	New York	117⅞	115⅛	115⅜	Jn.1, Jn.29, QX 1.75
U. S. Steel pfd.	New York	124⅛	123⅛	123⅞	My.5, My.29,Q 1.75
Virginia I. C. & C.	New York	...	...	33	Jan., 1924 1.50
Virginia I.C.&C.pfd.	New York	...	...	73	Jn.20, Jy.2, 2.50
VANADIUM					
Vanadium Corp.	New York	29	28⅛	28⅛	Jan., 1921 1.00
ASBESTOS					
Asbestos Corp.	Montreal	76⅛	68	70¾	My.1, My.15 Q 1.00
Asbestos Corp., pfd.	Montreal	109⅛	103	105	Ap. 1, Ap. 15, Q 1.50
SULPHUR					
Freeport Texas	New York	18⅞	16⅛	17⅛	Nov., 1919 1.00
Texas Gulf	New York	108	103¾	109	Jn.1, Jn.15, Q 1.75
DIAMONDS					
De Beers Consol.	New York	20⅛	20⅛	20⅜	Ja.6, Fe.2 0.95
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	3⅛	2⅛	2⅛	
MINING, SMELTING AND REFINING					
Amer. Metal	New York	48⅛	46⅛	48⅛	My.19, Jn.1, Q 0.75
Amer. Metal pfd.	New York	...	...	113⅛	My.20, Jn.1, Q 1.75
Amer. Sm. & Ref.	New York	105⅛	101⅛	103⅛	Jy.10, Au.1, Q 1.50
Amer.Sm.&Ref.pfd.	New York	110⅛	108⅛	109⅛	Au.7, Se.1, Q 1.75
Consol. M. & S.	Montreal	85⅛	83	83⅛	Jn.30, Jy.15 0.75
Federated Metals	N. Y. Curb	25	25	25	
Southwest Metals	N. Y. Curb			*80	
U. S. Sm. R. & M.	New York	36⅛	34	36	Ap.6, Ap.15 0.75
U.S. Sm. R.&M.pfd.	New York	45	44⅛	44⅛	April, 1925 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.

LONDON QUOTATIONS, WEEK ENDED JUNE 6

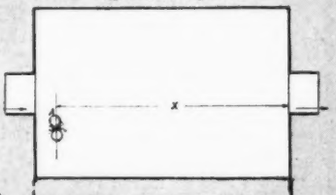
	High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)	76/10½	75/—	75/—	May 1925	5(c)
British Platinum	8/6	7/10½	8/6	Feb. 1925	2½
Bwana M'Kubwa	5/9	5/6	5/6		
Camp Bird	2/10½	2/7½	2/9		
El Oro	5/7½	5/3	5/6	Nov. 1924	2½*
Esperanza	1/1½	—/10½	1/—		
Frontino & Bolivia	12/—	11/6	11/9	1923–24	10
Mexican Corporation	13/—	12/6	13/—		
Mexico Mines of El Oro	50/—	48/9	48/9	June 1925	0.10*
Nechi (pref. 10s.)	1/6	1/3	1/4½	1921–22	25
Oroville Dredging	7/9	7/3	7/6	Dec. 1923	3⅜
Ouro Preto	6/—	5/—	5/6	May 1925	2½
St. John del Rey	17/6	17/—	17/3	June 1925	6¼
San Francisco Mines	25/9	25/3	25/3	June 1925	15
Santa Gertrudis	10/10½	10/3	10/6	July 1920	5
Selukwe (2s. 6d.)	15/9	14/4½	15/3	April 1917	6¾
S. American Copper	7/9	7/3	7/6	Nov. 1917	75
Tanganyika	32/9	28/9	30/—		
Tomboy	4/—	3/6	3/9	Feb. 1925	4⅛
Union Minière du Haut-Katanga (Brussels) 100 Fr.	5.290	5.175	5.175	July 1924	80(b)

* Free of British Income Tax. (b) Belgian francs. (c) Swiss francs.

pages 1-98 = index

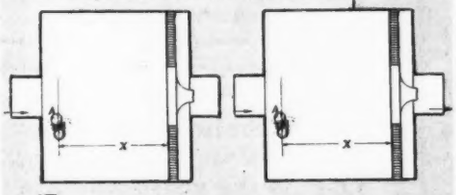
The A.B.C. of Tonnage Capacity

To secure the highest tonnage consistent with efficiency, the mill must be so designed as to eliminate finished material as rapidly as possible.

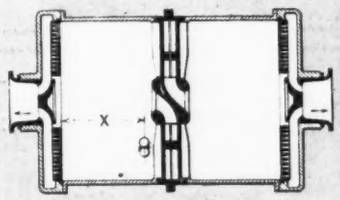


A. This long grinding compartment may produce a greater tonnage of material than a shorter one of the same type. However, the finished material formed at "X" and all along its length reduces its efficiency and increases consequent costs due to the extra load of "deadhead" ore and balls that must be rotated.

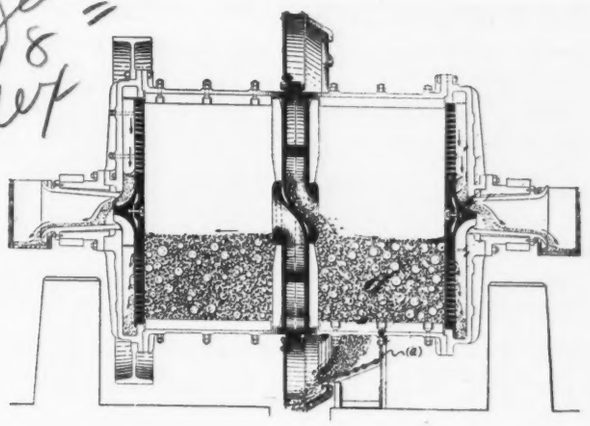
Awaiting discharge, this finished material occupies space that should be available for unfinished material and hinders the action of the balls.



B. These two single discharge ball mills will grind ore efficiently, metallurgically speaking, but their capacity per square foot of floor space occupied is less than that of "A." Furthermore, the duplication of parts and auxiliary equipment might, by increasing their initial and operating costs, offset any seeming advantage.



C. This Fairchild Double Discharge Ball Mill delivers the efficiency obtained from a grinding compartment of short length, maintains maximum capacity per unit of floor space and reduces initial, installation and operating costs.



Maximum Tonnage made as simple as A B C!

Look at the A, B and C Figures displayed in the panel on this page and you can see, at once, why the Fairchild Double Discharge Ball Mill assures you the highest tonnage possible from a given floor space. You will realize, too, that this A B C principle, which has been applied to the Fairchild, assures you the highest possible efficiency and the lowest possible initial and ultimate costs.

The capacity of a Fairchild Double 84½ Ball Mill may be double that of one normal 8-ft. by 6-ft. ball mill of the single discharge type. Two 8-ft. by 6-ft. mills together with their motors and other auxiliary equipment must be used to obtain the same capacity possible from one Double 84½, but the Double 84½ Ball Mill requires only as much floor space as one of the other two mills.

The details concerning this revolutionary grinding mill will be found in our Bulletin BM-2. *Send for it.*

VULCAN IRON WORKS
1733 Main Street, Wilkes-Barre, Pa.
Established 1849
New York Office: 50 Church St.
Chicago Office: McCormick Bldg.

VULCAN *of* WILKES-BARRE
FAIRCHILD DOUBLE DISCHARGE **MILL**

SEARCHLIGHT SECTION

USED EQUIPMENT & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches.....$4.50 an inch
4 to 7 inches.....4.30 an inch
8 to 14 inches.....4.10 an inch

Rates for larger spaces, or yearly rates, on request.

An advertising inch is measured vertically on one column, 8 columns—30 inches—to a page.

E.&M. J.-P.

POSITIONS VACANT

MINE master mechanics wanted, speaking Spanish and with knowledge steam plants and electricity. Write letter application giving full details to American Smelting & Refining Co., 1112 Mills Bldg., El Paso, Texas.

WANTED — Applications from experienced mine accountants, preferably with knowledge of Spanish, for work in Mexico. American Smelting & Refining Co., 1112 Mills Building, El Paso, Texas.

EMPLOYMENT SERVICE

SALARIED men seeking tentative offers of new connections, are invited to communicate confidentially with the undersigned, who will negotiate overtures without jeopardy to present connections. A professional, ethical service, restricted to high grade positions; established 1910. Retaining fee refunded as provided in our "Refund Contract" if service is not satisfactorily rendered as per contract, and such refund be requested within three months from date remitted. Send name and address only for particulars. R. W. Bixby, Inc., 704 Lockwood Building, Buffalo, New York.

EXECUTIVES, engineers, find our individual, confidential service effective in making new connections. Personally conducted by Mr. Jacob Penn, the eminent employment authority, known to leading business men throughout America. Refund agreement protects you. Not agency. Jacob Penn, Incorporated, 305 Broadway, New York.

EMPLOYMENT AGENCY

47 GRADUATES, mining and metallurgical engineers; 18 chemists, analytical work, mill and smelter laboratories, $115-$135; 29 mine surveyor helpers, samplers, salaries $120-$150. Positions in United States, Alaska, Mexico and Latin-America. Wire or write, no red tape, no delay. Interstate Employment System, First National Bank Bldg., Denver, Colo.

POSITIONS WANTED

EXPERIENCED mine surveyor and cost keeper desires position. Technical graduate, single. San Francisco interview. PW-235, Eng. & Min. Journal-Press 883 Mission St., San Francisco, Calif.

GRADUATE mining engineer, 4 years' mining experience; age 29; competent engineer and geologist desires position in United States. References. PW-233, Engineering & Mining Journal-Press, 883 Mission St., San Francisco, Cal.

GRADUATE mining engineer, 8 years' experience in Western United States and Africa, desires superintendency of mine or responsible charge of development work. PW-216, Eng. & Min. Journal-Press, Real Estate Trust Bldg., Phila., Pa.

MINING engineer open for engagement. Fourteen years' experience in N. W. United States and Mexico as miner, geologist, mine foreman and mine superintendent. Broad experience in mine examination and exploration work. Location immaterial. Age 35. Single. Fluent Spanish. New York interview. PW-237, Eng. & Min. Journal-Press, Tenth Ave. at 36th St., New York.

MINING or metallurgical engineer seeks engagement, charge of property or plant; broad experience U. S. Canada, foreign; operation, development, testing, arranging metallurgy plant; Spanish, French; location anywhere. PW-239, Engineering & Mining Journal-Press, 883 Mission St., San Francisco, Calif.

BUSINESS OPPORTUNITIES

Property For Sale

With 2 veins each, is 440 feet long and 8 feet wide, ore taken out of each vein assayed silver, 56¼ oz. per ton. Another sample out of one of them assayed gold, nine grains out of one pound of ore. A free option given. John Seabrook, R. R. No. 3, Havelock, Ontario, Canada.

For Sale

Mines and gold, silver and copper properties. Calmente Ibarra, Huatabampo, Sonora, Mexico. BO-240, Eng. & Min. Journal-Press, 7 So. Dearborn St., Chicago, Ill.

Silver, Copper, Lead Property For Sale

The undersigned as Attorney for the Receiver of the Butte Elk Park Extension Mining Company, will entertain offers for the entire assets of this company in order to terminate the Receivership.

Property is 14 miles northeast of Butte, Montana, and is one mile distant from Elk Park station on the Great Northern Railroad.

Property consists of 15 patented lode claims, six lode claims in process of patenting, and 587 acres of patented ranch lands adjoining. Country rock is Butte Granite. Extracts from reports of several mining engineers show several veins from 12 inches to 10 feet in width, with values in silver, lead and copper. Ore on dump assays from 1.68 to 2.84% copper, and 8.5 to 47 ozs. silver.

New, standard two compartment shaft 620 feet deep, with levels at 250 and 400, with some drifting.

Complete, up-to-date electric equipment installed at property consisting of 250-hp. Ottumwa hoist, two 1000 cu. ft. I. R. compressors, transformer, etc., etc., shop equipment, tools, supplies, ample buildings, cars, drills, etc.

Inspection of the property invited.

W. D. KYLE, Attorney
Butte, Mont.

FOR SALE

Lead Blast Furnace and Building

Complete with all necessary equipment. Used only three months. Located at Depue, Ill. Real bargain.

MINERAL POINT ZINC CO.
Marquette Building, Chicago, Ill.

A large placer carrying gold and platinum in appreciable quantities, at least 50c. per cu.yd., about 10,000 acres transportation, water, etc., a dredging proposition.

For sale or to let on royalty. Price and terms on application to

J. M. WOLBERT
311 Symons Building, Spokane, Wash.

FEED WATER HEATERS

1—Stickle 400 B.H.P. No. 4 Open Coil Feed Water Heater and Purifier complete.

1—American 400 B.H.P. No. 18 Feed Water Heater, complete.

3—Warren Webster Open Type Feed Water Heaters, 11,000 B.H.P. capacity each.

Nashville Industrial Corporation
Old Hickory, Tennessee

Calico District, Calif.

See article in Engineering & Mining Journal-Press, May 9, 1925. Mines and prospects for sale at reasonable prices and terms.

Properties shown or write to

H. W. BRITT, Daggett, Calif.

WANTED

Hydraulic Elevator

8-in. to 10-in. throat; Evans type preferred.

AMERICAN GEM MINING SYNDICATE
822 Security Building, St. Louis, Mo.

TUBE MILL

1—4x12 Allis-Chalmers Tube Mill, practically new. Silex lining and Norway pebbles.

Priced very low for quick sale.

NASHVILLE INDUSTRIAL CORPORATION
Old Hickory, Tennessee

FOR SALE

ROPE TRAMWAY

1800-ft. centers. Complete with loading and discharge equipment, automatic dump buckets, etc. Located at New Diggings, Wis. Real bargain.

MINERAL POINT ZINC CO.
Marquette Bldg., Chicago, Ill.

TRANSFORMERS

6—Pittsburg Outdoor Type 600 kva., 6600-2200 v., 60 cy., single phase.

3—Westinghouse Outdoor Type, 100 kva., 2400-240-120 v., 60 cy., 2 ph., Type S.

NASHVILLE INDUSTRIAL CORPORATION
Old Hickory, Tennessee

Surplus Equipment

Mining and Industrial, Electric, Steam, Gas, and Oil. Send for Catalog.

NEW JERSEY ZINC CO.
160 Front St., New York, N. Y.

SPECIAL LIST OF EXCELLENT EQUIPMENT

1—**Vulcan 225 HP. Electric Double Drum Geared Hoist,** with dial indicators; diameter of main shaft 7-in., size of drums 30-in. wide by 66-in. outside diameter; herringbone gears on first reduction, spur gears on second reduction; rope speed, 1,000 ft. per minute; approximate weight of hoist 60,000 lbs. Floor space 14x20-ft., including two reels of 1-in. hoisting cable, approximately 2,500 ft. each and one G.E. liquid Rheostat tank with motor switch, 3 HP. motor and pump, complete for control; hoist first class condition, but without motor.

2—**Allis-Chalmers Split Case Double Suction Centrifugal Pumps;** type HS, size 6, 1,500 gals. per minute, 275 ft. head, 1,760 r.p.m.; direct connected to Allis-Chalmers Motor, 150 HP., 3 phase, 60 cycle, 440 volt, 1,755 r.p.m., full load, complete with starters; first class condition.

1—**American Well Works Split Case Double Suction Centrifugal Pump,** fig. D.T., size 10-in., 235 ft. head, 2,500 gals. per minute; direct connected to Westinghouse 150 HP. Motor, 3 phase, 60 cycle, 440 volt, type CS, 1,750 r.p.m.; complete with starter; condition first class.

1—**American Well Works Split Case Multiple Stage Centrifugal Pump,** type KMD, size 6-in., two stage, 250 ft. head, 1,000 gals. per minute; direct connected to Westinghouse 100 HP. Motor, type CS, 3 phase, 60 cycle, 440 volt, 1,760 r.p.m., full load; complete with starter; condition first class.

Approximately 125 pieces 14-in. Inside Diameter **Wrought Iron Pipe,** 15 ft. long, with cast iron flanges peened on. Thickness of pipe ¼-in., diameter of flanges 23¼-in., thickness of flanges, 1⅝-in.; 10—1⅛-in. bolt holes.

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1—Blaisdell Duplex 14 and 22x14x14, complete and practically new.

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Old Hickory, Tennessee

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1—10 Hp. Crocker Wheeler 440 volt, 1720 r.p.m.
1—10 Hp. Westinghouse, 220 volt, 1200 r.p.m.
2—20 Hp. Gen'l. Electric, 440 volt, 900 r.p.m.
1—20 Hp. Westinghouse, 440 volt, 840 r.p.m.
1—20 Hp. Crocker Wheeler 440 volt, 865 r.p.m.
1—20 Hp. Crocker Wheeler, 220 volt, 1140 r.p.m.
1—20 Hp. Genl. Electric, 220 volt, 1200 r.p.m.
1—30 Hp. Westinghouse, 440 volt, 1140 r.p.m.
1—35 Hp. Genl. Electric, 440 volt, 720 r.p.m.
1—35 Hp. Fairbanks, 440 volt, 900 r.p.m.
1—35 Hp. Fairbanks, 440 volt, 1200 r.p.m.
1—40 Hp. Crocker Wheeler, 440 volt, 1200 r.p.m.
1—50 Hp. Westinghouse, 220 volt, 870 r.p.m.
1—50 Hp. Genl. Elec., 440 volt, 720 r.p.m.
3—50 Hp. Genl. Elec., 440 volt, 900 r.p.m.
1—50 Hp. Allis-Chalmers, 440 volt, 1200 r.p.m.
1—50 Hp. Gen. Elec., 440 volt, 514 r.p.m.
1—100 Hp. Gen. Elec., 440 volt, 865 r.p.m.
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1—50 Kva. Westinghouse, 3 phase, 60 cycle, 440 volts, 1830 r.p.m.
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150 K.W. Westinghouse, D.C., 275 volt, 200 r.p.m., direct conn. to 225 H.P. Erie Steam Engine.

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1— 50 hp. 2200 v. 900 r.p.m. Var. Speed Westg.
2— 50 hp. 440 v. 900 r.p.m. C. Westg.
1— 35 hp. 220 v. 900 r.p.m. G.E.
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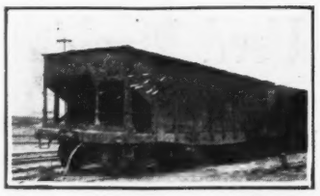

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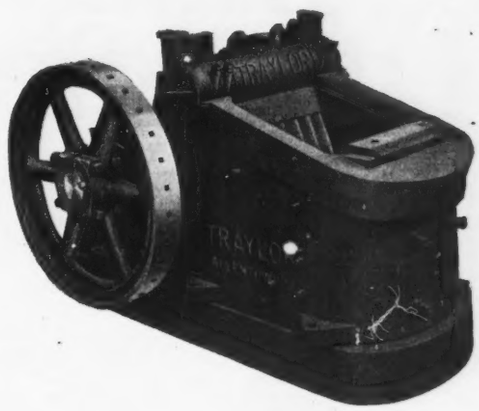

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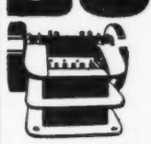

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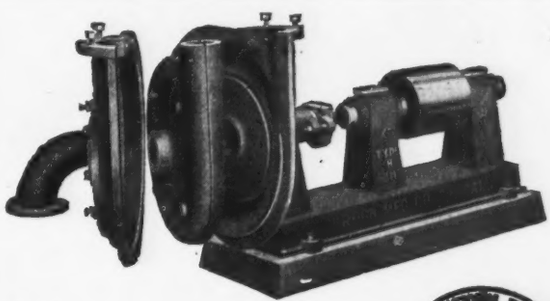

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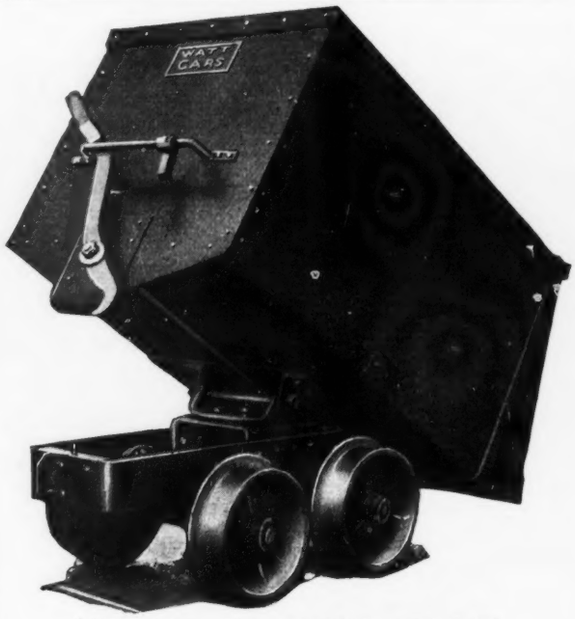

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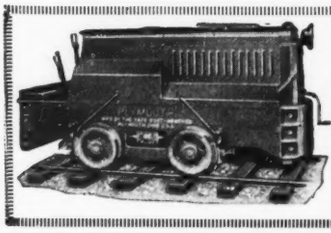

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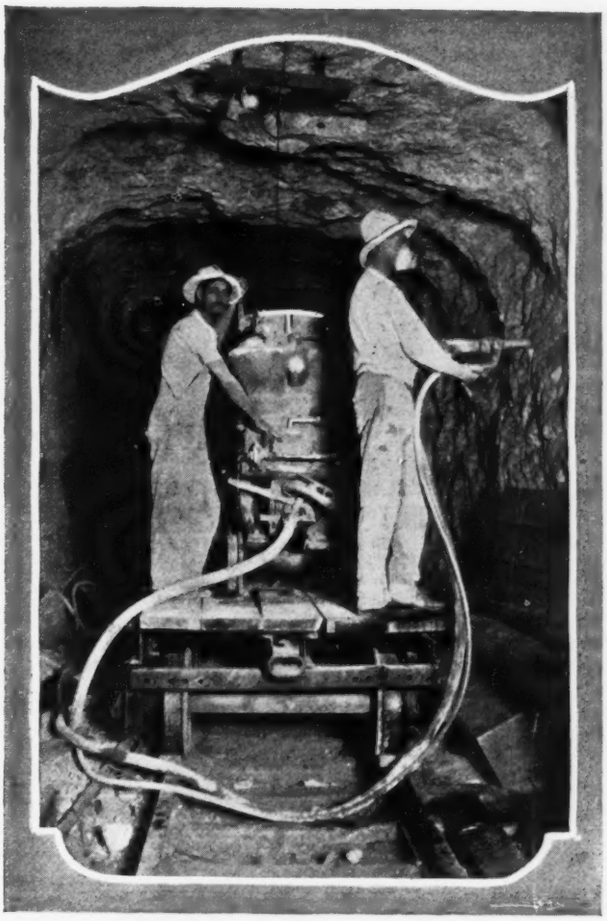

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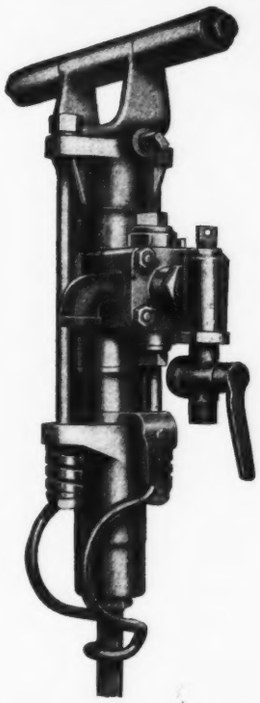

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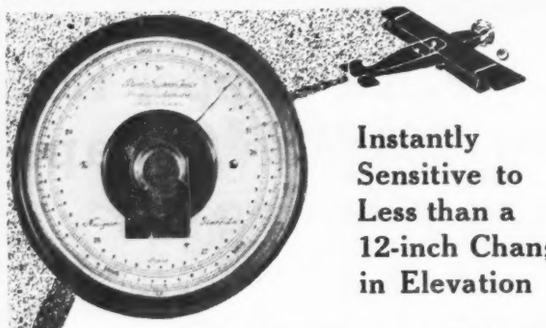

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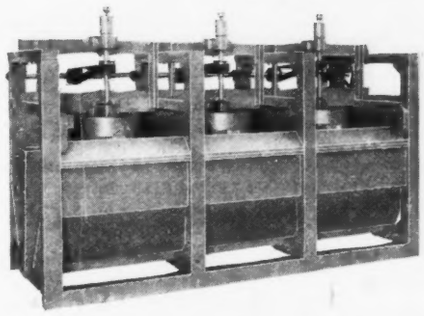

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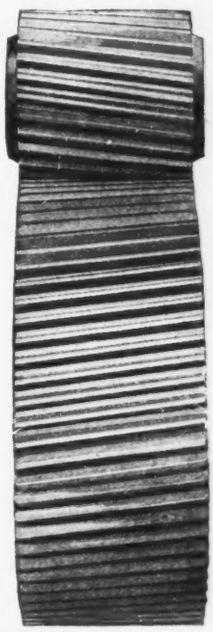

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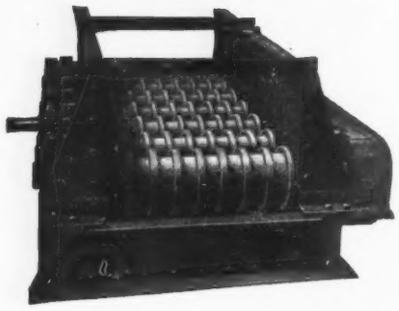

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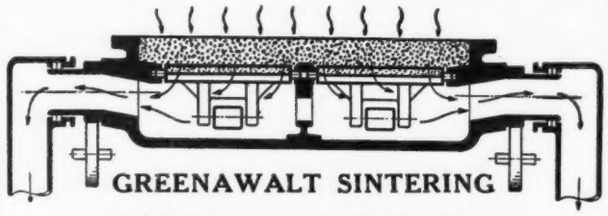

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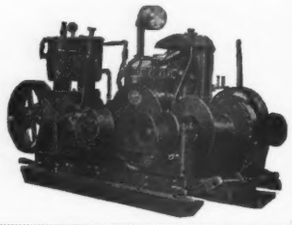

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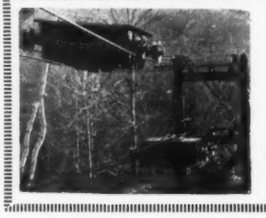

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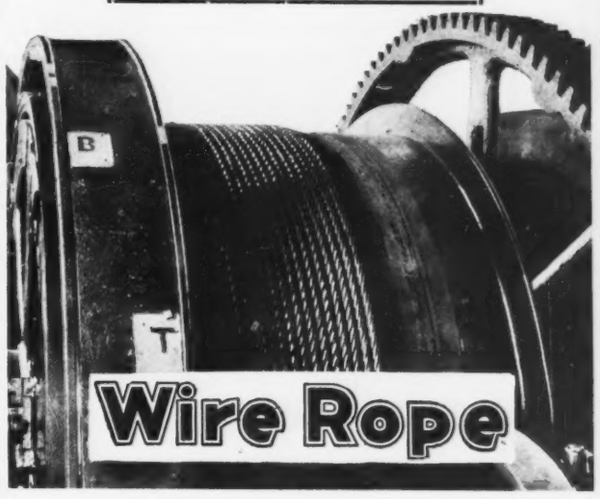

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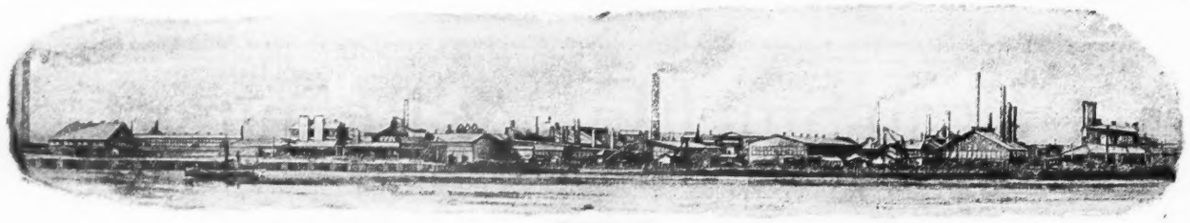

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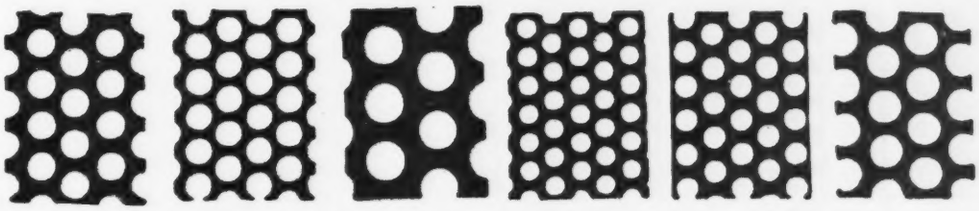

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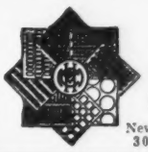

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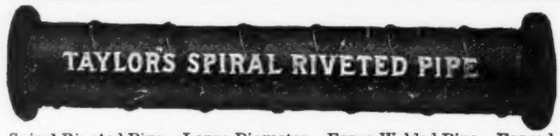

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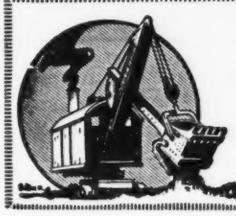

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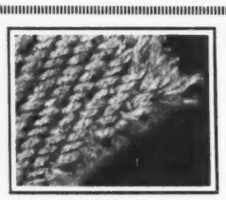

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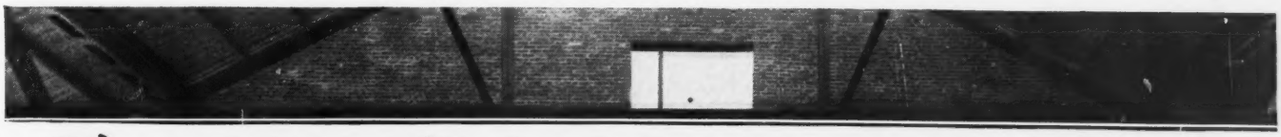

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